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ABSTRACT

A study investigated the influence of information technology (IT)-industry-sponsored credentials from both organizational and individual perspectives. A senior-level human resource (HR) executive from each of 33 organizations with 500 or more employees completed a paper-and-pencil questionnaire (response rate=66% of the 50 organizations comprising the sample for this study), while 245 IT employees from these organizations completed an Internet-based survey at the invitation of their executive (response rate can't be calculated). Findings indicated that HR executives still saw traditional four-year college degrees as the desired qualification for entry into the IT industry; they held attitudes that IT-industry-sponsored credentials assisted in the recruitment process, reduced training costs, and had a somewhat positive impact on training, learning, motivation to transfer learning, and job performance; the majority of HR executives believed industry-sponsored credentials reduced employees' sense of teamwork, camaraderie, and ability to solve problems creatively; and IT employees felt industry-sponsored credentials will influence the recruitment process and opportunities for further training and development. Additional analysis also found significant differences in the perceived influence of industry-sponsored credentials among those employees who have earned credentials as compared to those who have not. (Appendixes include 116 references and HR executive and employee questionnaires.) (YLB)

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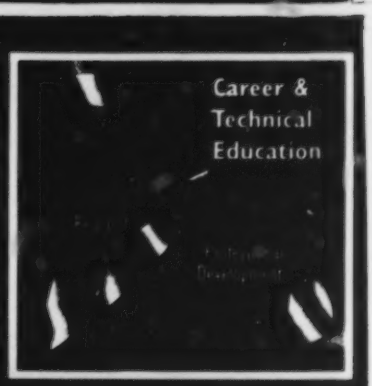

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ABSTRACT

The rise in the number of industry-sponsored credentialing programs in information technology (IT) raises many questions for Career and Technical Education because the development and growth of such programs is seen in an increasing number of fields. This study investigated the influence of IT-industry-sponsored credentials from both organizational and individual perspectives. Survey research was conducted with a sample of human resource (HR) executives from organizations that have a large number of IT employees. A web-based survey was administered to IT employees in a sample of these large organizations. Results show that HR executives and IT employees have different attitudes towards IT-industry-sponsored credentials in terms of their influence on recruitment, training, and organizational outcomes. Additional analysis also found significant differences in the perceived influence of industry-sponsored credentials among those employees who have earned credentials as compared to those who have not. Implications of the results are discussed for career and technical education policymakers, researchers, and educators.

NOTE TO THE READER

It is important to recognize the time period in which this study was designed and executed. At the time this study was conceptualized, the shortage of IT workers was making national headlines with numerous reports of high-compensation packages being paid to employees with little or no work experience, as long as they held the desired IT credential.

The slowdown in the United States economy, the demise of many dot.com firms, and the increasing competitive pressures for many other Internet-related businesses have influenced both the demand for IT workers and the role that industry-sponsored credentials play in the recruitment process. The impact of these events is captured to some degree in the findings.

The reader of this report is asked to consider the dynamic nature of the IT industry, the challenges of conducting research of this type, and the importance of considering the time frame of the study when drawing conclusions.

BACKGROUND FOR THE STUDY

> *The United States is currently confronting what can best be described as another industrial revolution. The rapid acceleration of computer and telecommunications technologies is a major reason for the appreciable increase in our productivity in this expansion, and is likely to continue to be a significant force in expanding standards of living into the twenty-first century.*
>
> - Alan Greenspan (1998, p. 1)

Information technology (IT) is increasingly recognized as the most important enabling technology for businesses around the world today. It is responsible for creating and revitalizing products, services, companies, and industries. According to a report by Meares and Sargent (1999), IT allows for better management of information and innovations, has resulted in improved productivity and quality of life, and has improved the national standard of living. The use of information technology has spilled over into every sector of the economy, from the traditional IT industry, to manufacturing and services, transportation, healthcare, education, and government. The pervasiveness of information technology across the U.S. economy and society is a testament to its impact and growing importance in almost all aspects of everyday life.

The rise in the number of credentialing programs is one the most significant trends related to education for information technology (IT) careers. These certificates were developed to provide well-trained workers and, in part, to address the shortage of qualified employees within the IT industry. Information-technology-industry-sponsored credentialing programs (such as CompTIA A+, Microsoft Certified Systems Engineer, Cisco Certified Internetwork Expert, Certified Novell Engineer, and Sun Certified Programmer for the Java Platform) have the advantage of enabling people to quickly learn a clearly defined set of competencies. At the completion of the programs, many students find multiple hiring opportunities, due to the current demand in the job market, although reports of the frequency of this demand-level have greatly diminished over the past two years. Yet, the impact of IT credentials in the recruitment process is largely unknown. This study addresses the issue.

This section of the report reviews a vast literature in the fields that framed the study. The intention is not to provide an exhaustive review of the existing literature, but rather to identify issues and research findings of significance to the current study. This background section presents operational definitions of major concepts used in the study and discusses the nature of the IT workforce, credentials, and recruitment. The discussion concludes with a statement of the research question and objectives that guide this study.

Operational Definitions

Many operational definitions are used throughout this report. Many of the terms in this research are used in diverse ways, which adds to confusion when exploring issues in credentialing programs and certification within the IT industry. The following terms define the concepts in this study.

Certification— "a form of credential awarded by an employer, a vendor, or an association or independent agency" (Hale, 2000, p. xx) requiring "passage of an exam benchmarked to predetermined occupations or professional standards" (Carnevale & Desrochers, 2001, p. 19). Certification may or may not require prior education and experience.

Credential—"a designation, mark, or stamp given to a person, organization, or program that has satisfied a set of standards" (Hale, 2000, p. xx).

Education degree—"credential awarded by an academic institution. These are academic degrees and professional degrees. An academic degree is concerned with general education, liberal arts, and sciences. A professional degree is concerned with the skills and knowledge of a specific profession" (Hale, 2000, p. xx).

Human resource management—"deals with the design of human resource structure of an organization to ensure the effective and efficient use of human talent to accomplish organizational goals" (Mathis & Jackson, 1997, p. 4).

Human resource development—"the study and practice of increasing the learning capacity of individuals, groups, collectives, and organizations through the development and application of learning-based interventions for the purpose of optimizing human and organizational growth and effectiveness" (Chalofsky, 1992, p. 179).

Information technology—"the acquisition, processing, storage, and dissemination of vocal, pictorial, textual, and numeric information by a microelectronics-based combination of computing and telecommunications" (Powell, 1999, p. 152).

Job satisfaction—"a global feeling about the job or as a related constellation of attitudes about various aspects or facets of the job" (Spector, 1997, p. 2).

Organizational commitment—"a psychological state that characterizes the employees' relationship with the organization for which they work and which has implications for the employees' intention to remain with the organization" (Allen & Meyer, 2000, p. 286).

Psychological contract—"a set of unwritten and implied individual beliefs regarding the terms of an exchange agreement between individual employees and their employing organization" (Rousseau, 1989, p. 122).

Recruitment—"a series of practices and activities conducted by an organization with the primary purpose of identifying and attracting potential employees" (Barber, 1998, p. 5).

Training—"a planned effort by an organization to facilitate employees' learning of job-related competencies, such as knowledge, skills, or behaviors that are critical for successful job performance" (Noe, 1999, p. 3).

Transfer of training—"the degree to which trainees apply the knowledge, skills, behaviors, and attitudes gained in training on their jobs" (Holton, Bates, Seyler, & Carvalho, 1997, p. 96).

The IT Workforce

There is little doubt that the information technology industry has risen to prominence, playing a dramatic and significant role in the U.S. economy. According to Meares and Sargent (1999), information technologies contributed more than a third of real U.S. economic growth between 1995 and 1997. Information technology's share of the U.S. economy nearly doubled between 1977 and 1998, growing from 4.2% to 8.2%. Developments in IT have also led to lowered costs of computing and the increased reach of information technologies into many new areas. The use of information technology has not only led to increased efficiency and productivity, it has also resulted in new business models and new approaches of how work is organized and completed.

It must be acknowledged that a degree of disagreement exists about the contribution of IT to the U.S. economy. A recent report from the Economic Policy Institute (Mishel, Bernstein, & Schmitt, 2001) suggests that factors other than IT help explain the recent productivity acceleration of the U.S. economy. These include growth in demand for many goods and services during a period of low unemployment that has forced greater efficiencies, accelerated improvements in the organization of work, and a rapid growth of workforce skills.

Despite the debate as to what constitutes the real drivers of recent economic growth and the impact attributed to the IT industry, it is clear that considerable demand is present for workers skilled in the design, development, maintenance, and use of information technology. Yet, significant confusion exists around the definition of the occupations and job titles that comprise the IT workforce.

IT Jobs and Occupations

The IT industry is a diverse industry with numerous titles and occupations. At the broadest and simplest level, the IT industry involves computer hardware, software, and professional services. The U.S. Department of Commerce Office of Technology Policy (1997) has further divided IT occupations into four categories: computer scientists, computer engineers, system analysts, and computer programmers.

Computer scientists: Computer scientists (CSs) have a higher level of theoretical expertise as compared to other computer professionals. They are involved in designing computers, conducting research to improve their design, and developing and adapting principles for applying computers to new uses.

Computer engineers: Computer engineers (CEs) often work as part of a team that designs new computing devices or computer-related equipment. They work with the hardware and software aspects of systems design and development.

Systems analysts: Systems analysts (SAs) use their knowledge and skills to understand the needs of organizations and how information technology can meet these requirements. They often work in problem-solving situations, studying data-processing problems, and designing new solutions using computers. They help an organization realize the maximum benefit from its investment in equipment, personnel, and business processes.

Computer programmers: Computer programmers (CPs) write and maintain programs or software, which are detailed instructions that list in logical order the steps that computers must execute to perform their functions. In many organizations, CPs follow descriptions prepared by SAs who have studied the task that a computer system is going to perform.

IT Workforce—Definition and Growth Projections

Regardless of how IT occupations are classified, the IT industry is one of the largest and most dynamic industries in the country. Evidence of the size of this industry is seen in the tripled number of workers employed in the last decade (Freeman & Aspray, 1999). A study published by the Information Technology Association of America (2001a) found that the current national IT workforce consists of 10.4 million workers. This number, however, does not include IT jobs in government, not-for-profit organizations, or small entrepreneurial firms. This under-reporting of the true size of the IT workforce reflects the fact that the IT sector is not the only area where information technology workers are being employed. Information technology workers are employed in almost all industries and business areas— where they are increasingly relied upon to design, maintain, and update critical organizational functions.

According to the U.S. Bureau of Labor Statistics (2000, February), employment in IT occupations grew 64% from 1988 to 1997. This is compared with an increase of 29% in all professional jobs, and an increase of only 13% in the total workforce during the same period (Freeman & Aspray, 1999). Other reports indicate that while IT-producing industries generated jobs at a substantially faster rate than other industries in the 1990s, IT industries contributed a small share of total job growth—about 7.5% of all new jobs. The core IT occupations, such as computer programmers, system analysts, and other job titles, made up 2.0% of all employment in 1999, up from 1.3% in 1989 (Mishel, Bernstein, & Schmitt, 2001). Disagreement over figures related to the historical growth of IT jobs is perhaps the result of the continuing confusion and disagreement about defining IT jobs and the boundaries of the IT industry. For a detailed review of the IT workforce, the reader is directed to the National Research Council (2001) report on building a workforce for the information economy.

In contrast, greater agreement exists with regard to future projections of employment growth in the core IT occupations of computer engineers, systems analysts, and computer programmers. Figures published by the U.S. Department of Commerce show a projected growth from 1.5 million jobs in 1996 to 2.6 million jobs in 2006—an increase of 1.1 million jobs. In addition, it is estimated that another 244,000 workers will be needed to replace those exiting these professions—raising the increase closer to 1.5 million jobs (Meares & Sargent, 1999). This projected increase in core IT jobs is mirrored in the list of the fastest growing occupations in the

Occupational Outlook Handbook, 2000–01, published by the U.S. Bureau of Labor Statistics (see Table 1).

Table 1
Fastest Growing Occupations in the United States

Occupations	Employment change 1998–2008	
	Number [a]	Percent of growth
Computer engineers	323	108
Computer support specialists	439	102
Systems analysts	577	94
Database administrators	67	77
Desktop publishing specialists	19	73

Note. [a] Numbers in thousands of jobs. From U.S. Bureau of Labor Statistics, 2000, *Occupational Outlook Handbook, 2000–01*.

It is common to see references to the IT workforce that assume a homogenous population of workers who use computers as a key feature of their daily jobs. A report by Meares and Sargent (1999), "The Digital Workforce: Building InfoTech Skills at the Speed of Innovation," however, describes a variation in the mix of knowledge, skills, and abilities required for IT jobs. IT jobs differentiate themselves in terms of the specific technical skill set needed, the industry knowledge and experience required, and other qualifications in areas such as project management, communications, and organizational skills. In addition, certain IT jobs are in extremely high demand, reflecting trends within the IT industry. Therefore, variations in market trends and IT job requirements result in a dynamic demand for IT workers in a wide variety of occupations.

The demand for skilled IT workers has not decreased with the recent economic slowdown, and the demise of many dot.com firms and other Internet-related businesses (Hilton, 2001). An Information Technology Association of America (ITAA) study (2001b) stated that although demand for IT workers in 2001 was down 44% from forecasts just a year earlier, estimates were that U.S. companies planned to hire an additional 900,000 IT workers during 2001. Of this total, 425,000 positions were likely to go unfilled because of a lack of applicants with the requisite technical and non-technical skills. While the exact numbers projected by the latest ITAA study are potentially open to debate given the constant fluctuation in labor needs, it is clear that, based upon current projections, the demand for suitably qualified IT workers still far exceeds the resource pool. The current growth projection is best summarized by ITAA, which concluded that the current demand for IT workers remains large, but substantially less than projections made in 2000.

There are many reasons why the need for IT workers has not decreased, despite the current economic slowdown. A recently reported Gartner study (Cantara & Palma, 2001, February) noted that despite decreased earnings across the technology sector throughout 2000, other core drivers of the IT professional services market still remain as strong as they have been over the previous 3 years. Though this report specifically refers to IT professional services, the demand for skilled IT workers is equally strong in other areas of the IT workforce as well. An ITAA study (2001b) confirmed this finding, predicting the largest job growth of IT workers in non-IT companies.

An increasingly diverse range of industries is placing more reliance on information technology and IT employees. Developments in technology result in changes in the nature of IT work, and the need for IT workers matching the new required skill sets. This creates competition for IT workers with specific "hot" skill sets (Meares & Sargent, 1999). These factors, coupled with the distinct business requirements of each industry, have created a growing demand for workers with unique combinations of IT skills, experience, and industry knowledge.

It must be acknowledged that not everyone agrees that the IT industry is experiencing a labor shortage. Capelli (1999) argued that the shortage of workers is not real: it is just a simple example of economic supply versus demand. According to Capelli, any shortage of IT professionals is a result of management practices such as ineffective recruitment and retention methods that support turnover of IT workers. Furthermore, he suggested that the most important challenge to the IT industry is related to the management of IT workers within companies rather than any existing or projected shortages of qualified IT workers. In a similar vain, Murray (2000) stated that the shortage of IT workers has less to do with the lack of qualified IT workers and more to do with the unwillingness of organizations to do what has to be done to attract and hire the needed people. This clearly suggests that HR departments play a major role in the difficulty individual organizations experience in locating, hiring, and retaining IT employees.

In summary, the growth projection of the IT workforce in the United States has been, and continues to be, the subject of considerable debate. Groups representing the IT industry refer to the problem as a shortage of workers—not enough people with the required IT skills to meet the demand (Kuncicky & Wynn, 1998). Others suggest that employers, in contrast, have not done enough to tap the vast pools of technically trained and certified people who are available in the country (Greenberg, 2000). A third perspective on the debate is presented by some economists who argue that skilled labor shortages in IT are a consequence of the rising importance of IT in the economy (Mishel, Bernstein, & Schmitt, 2001). In the long run, they believe that market forces will bring equilibrium to the situation. In conclusion, these diverse perspectives make it clear that the challenge facing the IT workforce, and therefore the U.S. economy, is a complex one that does not lend itself to easy solutions.

Response to IT Workforce Projections

In spite of the existing expansion and projected growth of IT career opportunities, the pace at which 2- and 4-year college graduates in the computer science, engineering, and mathematics fields are entering the workforce has shown no signs of increasing. The situation is so serious,

the U.S. Department of Commerce Office of Technology Policy (1997) issued a warning that the shortage of IT workers could undermine U.S. innovation, productivity, and competitiveness in world markets. This is due to factors such as the inhibition of cutting-edge technology, constrained industry growth, loss of trade, and increased labor costs. As a result, the IT industry is looking beyond the traditional pool of graduates for its new workers. For example, the IT industry is seeking ways to attract and recruit employees from the non-IT workforce, hoping these workers will fill the ever-increasing IT openings. Employers have tried to meet their own demands for IT personnel through aggressive recruiting, retraining existing IT workers, and hiring immigrant IT workers through the H–1B Program (Watts, 2001).

Yet, the dominant education providers to supply core IT employees continues to be 4-year colleges and private technical institutes (Information Technology Association of America, 2001c). The number of projected unfilled IT jobs remained constant despite the almost 1 million college graduates per year whose education includes preparation for work in the core IT occupations (Meares & Sargent, 1999).

The apparent gap between the number of college-trained IT workers and the needs of the industry illustrates how the training and career paths of IT workers today are quite different from those of the past. The linear model of high-school diploma, to college degree, to IT employment, is being replaced. Organizations with immediate IT human resource needs increasingly seek skill competency over education/training backgrounds—not caring if employees are drawn from traditional education or non-traditional training settings. In this scenario, credentials offered by industry-based groups are providing organizations with a pool of human resources with new IT skill sets that are easily identifiable as applicable to the specific needs of businesses.

Credentials

Much existing economic and education theory rests on the role and impact of credentialing as the key to workplace success and higher levels of workplace earnings. As Wonacott (2000) detailed, the most prominent credentials for the workplace are the traditional educational credentials of diplomas and degrees. Yet, a new trend is emerging, raising many questions about the current and future role of both traditional credentials and industry-sponsored credentials and certification.

Existing theory provides a strong conceptual framework for examining the role of credentials in recruitment. This study draws on two theoretical frameworks: signaling theory and contest mobility theory. A brief overview of both theories is presented.

Qualifications and credentials have long served as signals for organizations. Signaling theory, as explained by Spence (1972), suggests that prospective employees have both unalterable observed attributes, such as age and gender, as well as attributes that are subject to change at the initiative of the individual, such as the level of education. Spence referred to these alterable attributes as signals. This theory has been applied to the recruitment setting because employers have incomplete information about the knowledge, skills, and abilities of applicants; they therefore use qualifications and credentials as signals for making inferences about missing

information (Barber, 1998). Students can also use education as a signal in that they choose the type of educational qualification or length of schooling to signal their abilities to prospective employers (Weiss, 1995). The value that recruiters place on different qualifications can also act as a signal to applicants. For example, signaling theory suggests that organizational preferences for either IT-industry-sponsored credentials or more traditional college degrees provide applicants with information about prospective organizations and what type of skills and knowledge they value (Greening & Turban, 2000).

In addition to their signaling function for entry to an organization, credentials have long served as a foundation for career advancement and employee development decisions. Turner (1960) suggested that career mobility operates under two opposing systems: sponsored-mobility and contest-mobility. Under the sponsored-mobility system, selected employees receive high levels of support, guidance, and mentorship from supervisors. The contest-mobility system implies an open and fair contest for each promotion decision. The contest-mobility system assumes that an employee's attainment is the result of hard work, ability, and level of education and training. The current study adopted the contest-mobility approach to examine the perceptions of human resource managers towards different credentials in the IT industry. It also examined the perceived influence of these credentials on hiring decisions, and management attitudes toward IT employees. Based on existing literature and the contest-mobility approach, it was assumed that a 2- or 4-year college qualification would be more highly valued than an industry-offered credential.

Rise in Certificate Programs

It is noted that the external certification of workplace skills is emerging as a key educational trend in many countries (Acemogle & Pischke, 1999; Miller, Kellie, & Acutt, 2001). Cervero (2001) recently listed the rise in certification programs and their frequent connection to regulation of professional practice as one of the top five trends in continuing professional education. Bassi (1999, March) suggested that organizations offering for-profit training and certifications are expanding to fill the growing need for highly skilled workers needed by corporate America.

There is some evidence that professional certification programs trace their origin to a 13th-century Roman emperor (Snider, Marasco, & Keene, 1991), although their emergence in the United States is within the last 60 years (Holt, 1991) Despite the establishment of career-related certificate programs in the 1940s, the first significant rise to prominence did not occur until the 1970s, in response to "specific technological and professional demands for concise and concentrated studies" (Holt, 1991, p. 3). In a similar vein, Hale (2000) suggested that "the main driver behind organizations' either adopting an external certification or developing their own is to protect the safety, health, and welfare of the workers or the public" (p. 1). "Certification testing has become the instrument of choice for the 1990s, enabling most companies to make the determination of who is and who is not capable of performing the job" (Blair, O'Neil, & Price, 1999, p. 513).

In many diverse fields, including IT, automotive service, building trades, health care, and hospitality, the increasing number of credentials has been suggested as creating a "parallel postsecondary universe" outside the boundary of traditional higher education (Adelman, 2000, p. v). Argetsinger (2001, June 10) described certificates as being faster, cheaper, and more focused, and, consequently, the certificate has become the continuing education currency of choice. This has produced a delivery system for credentials and certificates that is "a labyrinth of for-profit and not-for-profit postsecondary institutions, professional, industry, and trade associations, commercial vendors, and government" (Carnevale & Desrochers, 2001, p. 26).

The current increased level of visibility of credentials, certificates, and the standardized skill sets that they represent raises questions for researchers in many academic disciplines. For example, sociologists have explored the societal implications of the way students with credentials as compared to those with traditional education qualifications make the transition to adulthood (Kerckhoff & Bell, 1998). Others have commented on the increasingly "credentialistic nature of our society" (Wright, 1997, p. 251). Economists have expressed interest in credentials for their impact on labor demand, employee wage levels, and productivity measures at both the organizational and national levels (Robinson & Manacorda, 1997). Furthermore, economists are revising existing theories and models of human capital to determine if external certification of skills impacts the extent to which organizations invest in training (Acemogle & Pischke, 1999).

IT Certification

Much media and research interest on credentials has focused on the IT industry, which now offers well over 100 industry-sponsored credentials and certificates (Gabelhouse, 2000). Despite the number of trends that impact the IT industry, it has been stated that the rise in the number of IT industry-sponsored credentials is one of the most significant (Barley, 1999, March). Bird (2001) noted that the success of well-known IT industry-sponsored credentialing programs, such as Certified Novell Engineer (CNE) and Microsoft Certified Systems Engineer (MCSE), led to software and hardware manufacturers, independent organizations, IT-industry-related professional associations, and a variety of other companies introducing their own credential and certification programs. The result is that "the range of programs now available can make choosing a program a daunting task, particularly for those who are new to the industry" (Bird, 2001).

It is important to recognize that certification extends far beyond the companies and organizations that create and maintain credential programs. Tittel (2000) describes the size of the multibillion-dollar/year "certification aftermarket" (p.1) of testing centers, IT training companies, publishing companies, practice-test vendors, certification authorities, online mentoring, and resource providers. It is reported that the worldwide market for IT certification training and testing had reached $2.5 billion/year by the end of 1999, with predictions that it will have surpassed the $4.1 billion mark by the end of 2003 (IDC, 1999). The increase in the number of organizations offering for-profit IT-industry training and the increased number of IT credentials and certifications are usually interpreted as industry-driven responses to the growing need for highly skilled IT workers.

There is evidence to support the argument that the IT worker shortage is the driving force of the rise in IT certification. Some IT executives have identified the lack of skilled and trained employees as a barrier to their companies' growth (Information Technology Association of America, 2000, 2001b). This human-resource acquisition and HRD-related issue was ranked over economic conditions, firm profitability, lack of capital investment, taxation concerns, and government regulation. The need for highly skilled and well-trained workers able to demonstrate their expertise raised the demand for certification programs developed and offered by IT companies.

Certification programs appear to achieve multiple aims for IT companies. First, they provide focused training for employees seeking to enter or advance within the IT industry. These employees then require minimal technical in-house or on-the-job training. Second, credential programs may also increase the market share of IT companies in preparing a population of IT professionals with highly developed skills related to a particular product or service. This may, in turn, result in IT professionals encouraging the companies they work for to specialize their computer operations around a single IT product/service or a range of products/services, to match their training and credentials.

Lemen (2001, January–February) noted that the expanding variety and complexity of computer software, hardware products, and their related applications have created and will continue to create a specific demand for employees with unique combinations of IT skills, experience, and industry knowledge. Certification is well-suited to the dynamic nature of the IT industry because certification systems operate outside traditional structures usually associated with education credentials. Therefore, they are capable of responding quickly to new methods and technologies (Wright, 1997). Lastly, it may well be that IT companies have viewed the development of credentialing programs as an additional revenue source. More specifically, some forms of vendor-sponsored certification are thought to trace their origins and continued evolution to the ultimate purpose of increasing the sponsoring corporation's profits (MCSE, 2000).

Regardless of the disagreement about the aims of IT certification, a situation has emerged in which IT professionals and trainers struggle with certification while "the certification frenzy swirls about them" (Ray & McCoy, 2000, p. 1). IT credentials and certification are increasingly recognized for what they are and what they are not. A more complete view of the advantages and disadvantages of IT-industry-sponsored credentials and certification is apparent within the IT trade literature, although the issue lacks the benefits of more detailed examination and research.

Industry- or company-sponsored credentials can be viewed as instruments for judging knowledge, skills, and abilities in narrowly defined topic areas, typically based on specific vendors, particular organizational needs, and client-driven preferences. Such programs have the advantage of enabling people to learn a clearly defined set of competencies—an advantage that frequently results in employment opportunities due to the current demand in the job market. However, it is not just entry-level employees who benefit from industry-sponsored IT credentials and certification. Some evidence suggests that certified IT employees receive higher salaries than employees without certification (DataMaster Business Solutions, 2000).

At the organizational level, industry-sponsored certification is believed to play an important role in determining the desired knowledge, skills, and abilities that applicants should possess. Furthermore, requiring certain credentials and certifications is also said to make the recruitment process more efficient and aid in assessing applicants' abilities (Ray & McCoy, 2000). Despite potential reliability concerns, various IT-related firms have publicized their own research into organizational results when comparing certified IT employees to those without certification. For example, a study by IDC (1999) reported that 92% of the responding managers see their certified IT employees, when compared with their non-certified IT employees, as possessing greater knowledge, demonstrating increased productivity, improving customer support quality, and expressing higher morale and commitment, while concurrently requiring less training investment. Likewise, a study on IBM Certification found various positive influences on measures of business results such as increased revenue, employee productivity, and customer satisfaction (IBM, 1999).

The potential disadvantage for individuals earning industry-sponsored IT credentials is that some people, lured into the job market directly from high school or out of postsecondary programs in which an industry-sponsored credential is earned, may find a comparatively high-wage job with a short life cycle. A 1998 article in *Forbes* magazine profiled several young adults who had dropped out of high school or college, started IT companies, and now head multi-million-dollar/year IT companies. That the author (McMenamin, 1998, December) titled her article "the tyranny of the diploma" illustrates the perceived glamour, freedom, and high earnings of the IT industry to young people possessing the desired technical skills. Yet, early entry into the IT workforce may mean that continued education and training opportunities are forsaken or foreclosed. Premature entry into the job market also raises many questions in terms of workplace readiness (O'Neil, 1997). The result is that some employees may find that continued career advancement is difficult because they lack the broad range of desired skills and abilities required for today's occupations such as those detailed in the SCANS report (Secretary's Commission on Achieving Necessary Skills, 1991). Recent changes in the IT industry have seen a reduction in the number of young people entering jobs with certificates but no experience.

Many new employees in the IT industry are also discovering the "over-glamorization of digital labor" (Terranova, 2000, p. 33). Terranova noted that IT employees describe themselves as "NetSlaves," and "24-7 electronic sweatshop workers," and they "complain about 90-hour workweeks and the moronic management of new media companies" (p. 33). Such experiences are likely to influence the work-related attitudes of employees and impact long-term career development plans.

Discussion at the organizational level of the disadvantages of industry-sponsored IT credentials and certifications tends to revolve around issues of their worth to the organization. One key concern for organizations is the continued high turnover levels of employees with highly sought-after qualifications. Gillin's (1994) call to human resource managers to "tame the restless computer professional" (p. 140) reminds us that retention is not a new issue for the IT industry. According to Fabris (1998), the annual IT industry turnover rate is 14.5% (although

rates of 25% and higher are reported in some firms), which results in on-going efforts and costs to recruit and replace IT workers.

The focus of industry-sponsored IT credentials on tightly defined workplace standards and less emphasis on broad education has raised organizational concerns that employees who hold only certifications lack the broad knowledge-base needed to advance new knowledge in the IT industry. Employees with one or more credentials or certifications from a single vendor potentially lack the integration skills increasingly needed in the IT industry. In addition, industry-sponsored certification is also seen as a potential disadvantage because such employees find it difficult to understand and connect new products to existing operations, resulting in workers who feel frustrated and less engaged with new innovations. These concerns are expressed in P. J. Connolly's interview with Tom Yager—that "not only do employers overestimate the value of certificates, but some certificates are so easily obtained, they're barely worth valuing at all" (Connolly & Yager, 2000, p. 3). Yet, the question of the influence of industry-sponsored credentials remains. The focus of this report will now shift to recruitment as a setting for further exploration of the influence of IT-industry-sponsored credentials from the perspective of individual IT employees and organizations.

Recruitment

The ultimate test of a qualification is its value and utility to the holder. One way this could be expressed and examined is the influence and impact of different qualifications in the recruitment process. As the management practice that announces need, attracts, and selects human resources, recruitment is an important arena in which to examine the potential influence of industry-sponsored credentials within the IT industry. Recruitment is a topic of great interest to industrial psychologists, organizational behavior researchers, and human resource management researchers and practitioners because recruitment has been shown to have a strategic impact on organizational performance (Bamberger & Meshoulam, 2000). More specifically, the recruitment and screening practices adopted by an organization have a significant impact on the flow of human capital into the organization, as well as the ability of the organization to retain these employees. In addition, recruitment plays a key role in establishing person-organization fit. The fit perspective suggests that individuals have different "emotional and psychological needs and that they will seek jobs that best fit their individual needs" (Barber, 1998, p. 103).

This section will define and describe the recruitment process and summarize the substantial literature on the topic. More specifically, this section outlines the recruitment process as a component of strategic human resource management, and it identifies key players, dimensions, and outcomes of the recruitment process. The discussion then shifts to the recruitment of IT workers and reviews the limited number of research studies that have examined the organizational and employee perspective of recruitment in IT industries. This review is provided because the current study focuses on the potential impact and influence of industry-sponsored certification on recruitment.

Recruitment Defined

Despite the key role that recruitment plays in the management of human resources, no widespread agreement exists as to how recruitment should be defined. In general terms, recruitment can be described as the process that "encompasses all organizational practices and decisions that affect either the number, or types, of individuals who are willing to apply for, or to accept, a given vacancy" (Rynes, 1991, p. 429). In a similar acknowledgment of both organizational and applicant roles, Breaugh (1992) defined recruitment as "organizational activities that (1) influence the number and/or types of applicants who apply for a position and/or (2) affect whether a job offer is accepted" (p. 4). A more recent definition suggested that recruitment is simply "those practices and activities carried on by the organization with the primary purpose of identifying and attracting potential employees" (Barber, 1998, p. 5).

The Recruitment Process

The recruitment process is complex (Barber, 1998). To understand this process and summarize recruitment research, it is necessary to identify key dimensions or elements of recruitment. This section relies heavily on the organizing framework of Barber (1998) to describe the actors, activities, and outcomes of the recruitment process, as well as the context that can exert influence on the process.

Actors. The actors, also frequently referred to as players, in the recruitment process are simply those individuals and/or organizations that play a role in recruitment activities. Existing research has focused on the two most important actors—applicants seeking a job and organizations seeking to hire. Significantly more research has focused on the applicant's perspective (supply-side) than on the organizational perspective (demand-side). According to Barber (1998), many applicant-oriented studies have examined applicant reactions to the organizations' recruiters, recruitment practices, or factors that influence job-choice decisions. An important research finding has been the realization that the applicants' perceptions of the recruiters' behaviors and attitudes are associated with applicants' expectations of receiving a job offer and their reported probability of accepting the offer (Harris & Fink, 1987; Macan & Dipboye, 1990; Taylor & Bergmann, 1987). This suggests that applicants' perceptions of the recruiters' attitudes and behaviors towards different types of qualifications may influence the recruitment process and its outcomes.

The limited research available from the organizational perspective has been almost exclusively on large organizations (Rynes & Barber, 1990; Taylor & Giannantonio, 1993). Perhaps the lack of recruitment research conducted from the demand side (organizational perspective) is a result of variability in organizational approaches to recruitment, as well as organizational-specific differences that make comparisons across organizations difficult.

Increasingly important actors in the recruitment process, especially within the IT industry, are external organizational agents. External organizational agents such as advertising agencies, recruitment firms, and headhunters act in the interests of the recruiting organization. The

influence, roles, and impacts of external actors in the recruitment process have gone largely unexamined despite recent trends toward their increased use in the marketplace.

Activities. The major activities associated with recruitment include defining the labor market that will supply applicants, choosing the medium or source to deliver the recruitment message, managing communication between the applicant and the organization, and overseeing general administrative issues. (It should be noted that issues regarding applicant selection are considered to be a separate issue within the human-resource-management literature). Each of these will be briefly described.

The definition of the labor market refers to decisions regarding where the organization should direct its recruitment focus. Possible options include specific local, national, and global sites, and applicants with specific educational backgrounds, qualifications, or skills. The choice of medium or source refers to the method used to reach the target population; methods could include word of mouth, employee referrals, job fairs, advertisements, and employment agencies. Communication between the applicant and the organization usually starts with the delivery of the recruitment message through the medium or sources decided on by the organization. The initial communication from the organization needs to attract the applicants' attention, be understandable, be viewed as credible, and be able to generate interest from potential job applicants (Breaugh & Starke, 2000). "General administrative procedures" refers to policies and practices for managing the overall recruitment function that may have either an internal (organizational) or external (applicant) focus. The internal perspective would include performance management of those involved in recruitment, as well as procedures used to evaluate recruitment effectiveness. Applicant-directed activities would include issues such as how applicants are notified of the status of their applications, and how applicants are reimbursed for their recruitment-related expenses.

As noted by Rynes (1991), much research on recruitment has concentrated on the influence of different recruitment sources, applicant reactions to specific types of recruiters, and the nature of the recruitment message (e.g., if it is exclusively favorable, or if it presents a more realistic preview of the job and organization). There are fewer studies that examine multiple recruitment activities and, therefore, little understanding regarding the interaction among recruitment activities. This current situation of research prompted Breaugh and Starke (2000) to conclude that despite the many research studies, not a great deal is known about why recruitment activities have the effects they do.

Outcomes. Although outcomes associated with recruitment are of considerable interest to organizations, they are not easily assessed. Organizations are interested in attracting certain numbers of potential employees who have specific attributes. The success of recruitment is usually defined as the extent to which the organization achieved its recruitment goals (Breaugh & Starke, 2000). Successful recruitment is also defined in terms of long-term outcomes, such as the post-hire behaviors and attitudes of the employees hired. Such behavioral measures include job performance, ability to perform in a team environment, career advancement, and length of employment, with examples of attitudes such as job satisfaction, organizational commitment, and turnover intentions. Research exploring the causal factors of job behaviors and work-related

attitudes that only considers recruitment practices has been criticized for overlooking the many interrelated factors that influence individuals' attitudes and behavior.

In the current study, a series of relevant job attitudes and behaviors were examined. Perceived access to training and motivation to transfer learning are important variables to consider in light of the on-going skill updating required for IT professionals. While these variables could be considered antecedent, they are conceptualized in the current study as recruitment outcomes potentially influenced by the type of qualification (traditional college degree or IT-industry-sponsored credential). Three additional outcome variables of recruitment are considered in this study: organizational commitment, job satisfaction, and turnover. The research on recruitment outcomes, taken in aggregate, suggests that recruitment practices do have an effect on higher-level organizational outcomes such as productivity, profitability, and other performance measures.

Context. Context factors are classified as either external or internal. External factors include aspects of the environment outside the recruiting organization. The state of the labor market is one such factor. As indicated by the recent low national unemployment rate, as well as the limited supply of IT professionals, employment-related supply and demand clearly fluctuates over time. Organizational strategies may vary depending on work supply and demand-side competition. Internal context factors focus primarily on an organization's characteristics such as its business strategy (type of employees needed, relative importance of human capital), its economic position (ability to pay), and its attractiveness to potential applicants. Although it is yet to be investigated, it is possible that IT-industry-sponsored credentials operate as both external and internal contextual factors in recruitment. The popularity of industry-sponsored credentials may prompt HR managers to develop policies and procedures related to the recruitment of applicants with these credentials. Even the decision to state a preference for certain types of industry-sponsored credentials in the job announcement or advertisements may be more influenced by external factors (the general popularity of IT credentials) than any other reason.

Recruitment of IT Workers

One of the most difficult challenges that IT managers face is the identification, recruitment, and retention of competent IT employees (Agarwal & Ferratt, 1998). The average per-employee recruiting costs for IT are among the highest of any industry (Goth & Blank, 1999, March–April). The importance of recruitment within the IT industry has focused attention on exploring how organizations match the demand and supply for IT professionals.

The current and future job-growth projections and skilled-worker shortages discussed above highlight the need for a more thorough examination of recruitment for the IT industry. Barr and Tessler (1998) suggested that recruitment would become an issue on which the very survival of IT would depend. In the last 5 years, issues related to recruitment have seen "IT professional compensation soar, turnover has rocketed to 15% to 20% annually, job-hopping has become the norm, and only eight out of ten IT positions get filled with qualified candidates" (Pare & Tremblay, 2000, p. 1). To address this critical issue of matching the demand for and supply of IT professionals, a new cooperative partnership among an organization's strategy, human resource

management, human resource development, and IT functions is required. Such an approach recognizes the vital role of IT to an organization, the labor market conditions, the changing demands for qualifications of IT professionals, and the growth needs of these employees (Stam & Molleman, 1999).

One approach advocated for organizations with IT recruitment and retention concerns is to become an "employer of choice." Caron (1998, September 14) used this term to describe an integrated recruitment and retention approach designed to make people "want to work here by offering competitive salaries and benefits, promotion programs, and creating new incentives and opportunities" (p. 299). In a recent empirical study of the linkages between the business strategy of IT firms and the inducements offered during recruitment, it was found that incentives and career development opportunities were more attractive to applicants than compensation solely focused on salary and benefits (Higgins, 1998). In their study of 56 senior IT and human resource executives from 32 organizations, Agarwal and Ferratt (1998) identified 4 recruitment and 11 retention strategies noted as being typical of successful organizations. Based on their results, the authors developed a conceptual taxonomy of IT recruiting practices. Interestingly, the use of industry-sponsored credentials as one hiring criterion is not explicitly mentioned.

The recent increase in the status of IT-industry-sponsored credentials raises many questions in terms of the role of credentials as signaling devices for hiring, promotion, and career development. It is not known what the value and impact of IT-industry-sponsored credentials are for both individuals and organizations. However, the question of why industry-sponsored credentials are used by organizations recruiting for IT employees can be answered by labor economic theory. The Dutch economists van Ours and Ridder (1992) described the theory of firm vacancies. They defined a vacancy as "an employee slot that an employer would like to fill *immediately*" (p. 140, italics in original). They go on to state that firms have vacancies because it takes time to find a suitable employee for a specific job, since most jobs require specific skills, and only some job seekers have these skills. Extending their theory to the IT setting, a dynamic industry with high national levels of vacancies, firms would be expected to actively seek ways to reduce the time it takes to place a suitably qualified employee in an existing vacant slot. Rather than develop formal or informal tests to assess an applicants' required skills, organizations rely on credentials and certifications.

Existing research suggests that the preference for IT credentials appears to differ among organizations. In a study of newspaper recruitment advertisements placed between April 1998 and April 1999, Adelman (2000) found only 21% of advertisements required a college degree. By comparison, Adelman found one out of eight job advertisements mentioned IT-industry-sponsored credentials as a preferred background, with this changing to one out of seven in a one-month follow-up conducted in March 2000. Adelman suggested "within a few years, perhaps one out of five [recruitment advertisements] will do so—the same ratio as we currently find for formal postsecondary credentials (though formal degrees are usually requirements, not enhancements)" (p. 8).

The preference of employers toward formal qualifications, certification, and previous experience is not clear. Leman (2001, January–February) reported that some IT organizations acknowledge that industry-sponsored certification is less important than job-related experience. Yet, many IT recruitment firms note that the majority of their clients request certification. Others suggest that some employers recruiting IT employees simply look for the appearance of well-known acronyms of industry-sponsored credentials, assuming that their presence on a resume implies well-defined skill levels (Kuncicky & Wynn, 1998). The results of a study completed by Certification Magazine (Gabelhouse, 2000) reported that 77% of respondents hold an IT-related certificate, with 85% planning to receive at least one additional certification in the next year. It is fair to suggest that these IT employees would not invest the time and money in earning credentials unless they anticipate some benefit or return. A recently published CompTIA study (The Computing Technology Industry Association, 2001) found that 41% of responding companies noted that IT certification is playing an increasingly important role in recruitment and retention. As such, industry-sponsored IT credentials may serve a symbolic or functional role in recruitment (Segalla, Sauquet, & Turati, 2001).

This review of the background literature has suggested that IT-industry-sponsored credentials appear to have a positive future. Yet, a number of key issues are emerging that will influence the development of new credentials and the maintenance of existing programs. First, the proliferation of credentials in IT has created a degree of confusion for students and employers as to the specific knowledge that each credential certifies. In response, the IT industry is now recognizing the need to consolidate the number of available credentials, and is developing criteria for ranking existing credentials and certifications that are independent of any one vendor or association (ExamCram, 2001a). The second major issue regarding IT credentials is to determine the outcomes to both employees who hold industry-sponsored credentials and to the organizations that are increasingly reliant on their documented areas of IT expertise. It is noted by Carnevale and Desrochers (2001) that in more dynamic labor markets such as the IT industry, "employees need to be more loyal to their own certifiable skills than to their employers" (p. 43). Even concern continues about the lack of research support for the impact on both organizations and individuals of industry-sponsored credentials, the immediate result is likely to be a greater offering of IT-industry-sponsored credentials.

Research Objectives

The rise in the popularity and apparent impact of IT-industry-sponsored credentials prompted this research. Considering the lack of existing research, this study focused on credentials in a single industry and on a single impact. The research question guiding this study was: How do IT-industry-sponsored credentials influence the recruitment of human resources in the information technology industry? This broad question was refined into three objectives:

1. Determine the role of IT-industry-sponsored credentials in the recruitment process for IT employees in large companies representing a diverse range of industry clusters.

2. Determine the prevalence of credentials among applicants for IT-related positions in large companies representing a diverse range of industry clusters.

3. Compare work-related attitudes with demonstrated relationships to performance outcomes between IT industry employees who hold IT-industry-sponsored credentials and those employees with more traditional qualifications from 2- and 4-year colleges and universities.

These three research objectives were purposely broad, given the lack of existing literature and the exploratory nature of this study. During the literature review and instrument design, an organizing framework was developed to operationalize the objectives and to provide a road map to guide the implementation of the study.

This organizing framework is presented for the two populations under investigation: Human Resource executives and IT employees. The organizing framework for the HR executive component of this study draws on existing literature that examines the characteristics of the organization, the different types of qualifications desired of applicants, and the actual qualifications of the incumbent workforce. The influence of these different qualifications on the recruitment process, training and development, and selected organizational outcomes were also considered as important components of the study. This organizing framework for the HR executive component of the study is presented in Figure 1.

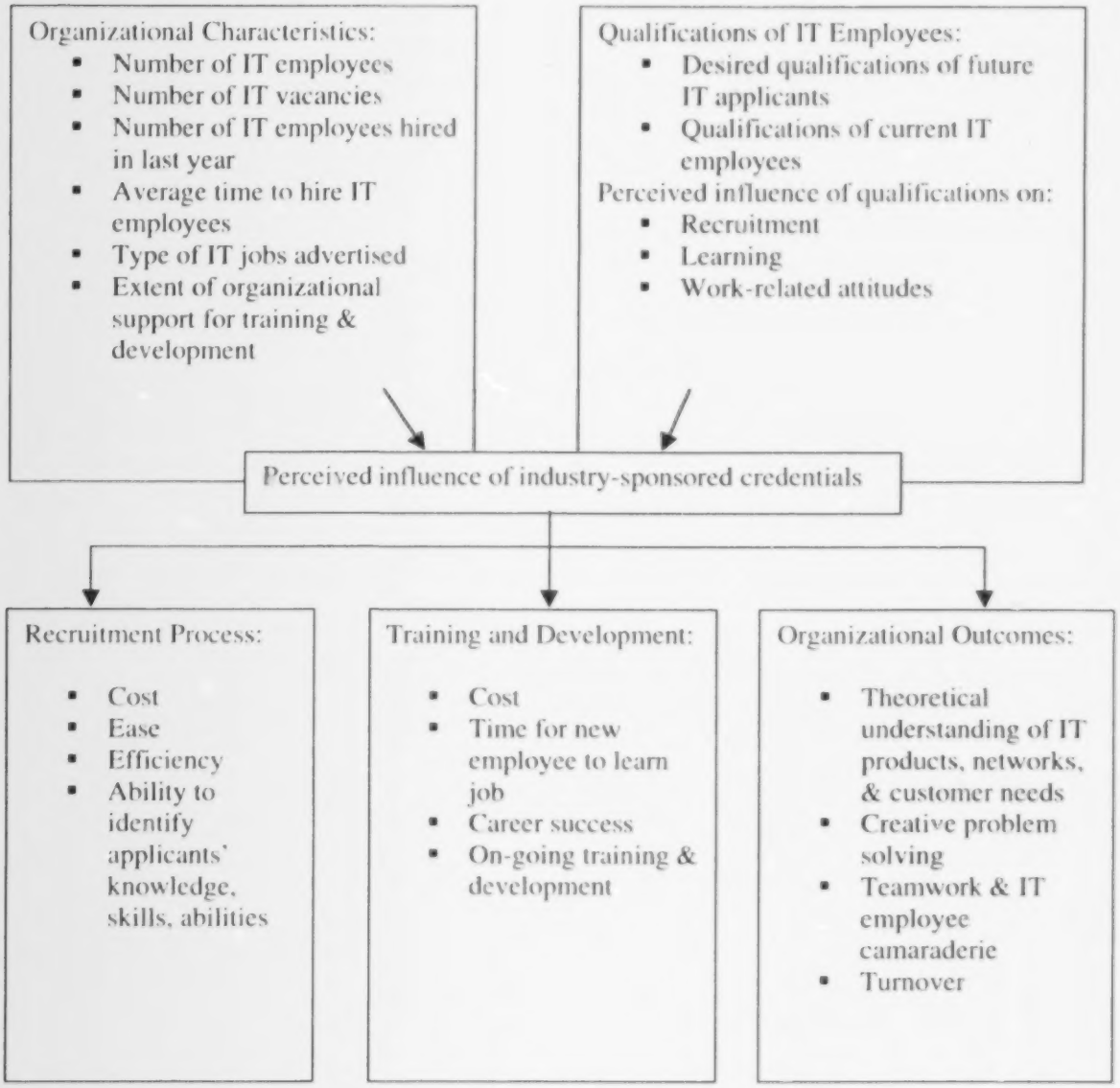

Figure 1: *Organizing framework for HR executives.*

Similarly, the organizational framework for IT employees draws on existing literature. The main areas considered are the backgrounds of employees, the types of qualifications they hold, and the perceived influence of different types of qualifications on recruitment, training, and selected individual and organizational outcomes. The organizational framework that guided instrument development and implementation of the IT employee component of the study is presented in Figure 2.

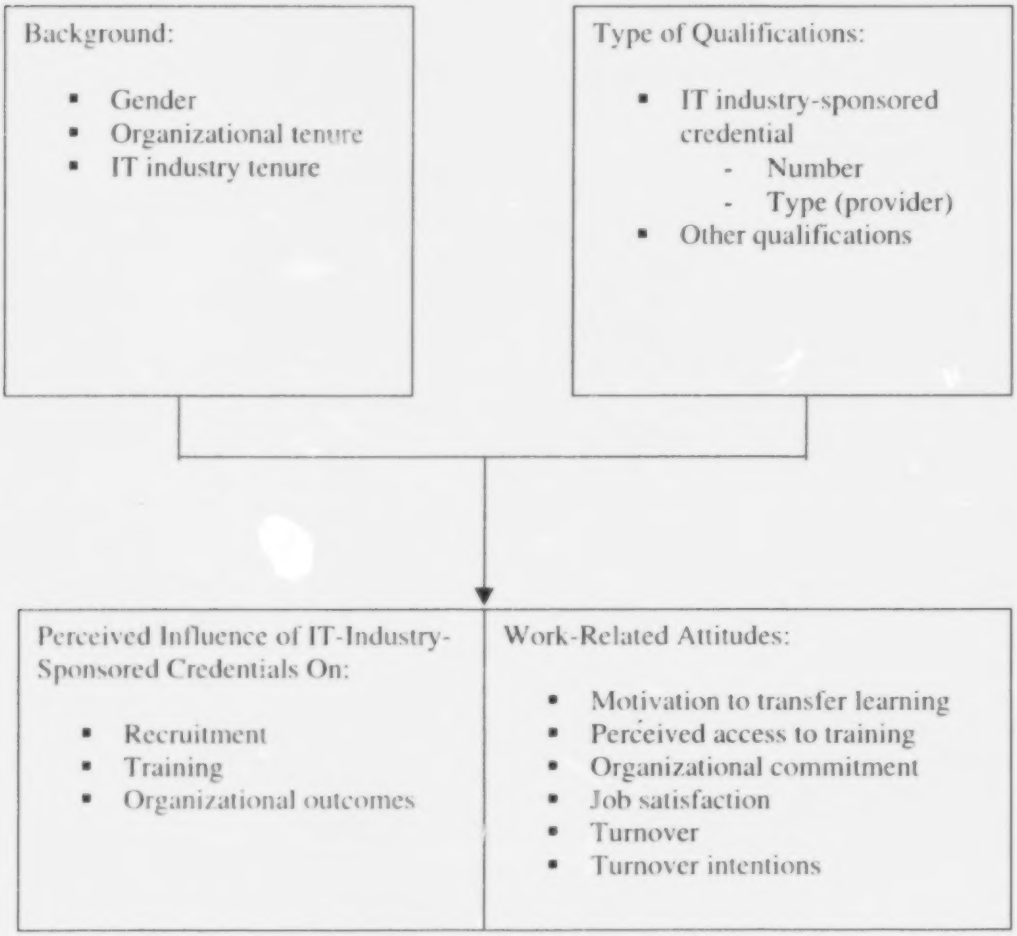

Figure 2: *Organizing framework for IT employees.*

The next section of this report details the method used to address the research question and objectives for the study.

METHOD

This section of the report describes the overall research design. The population, procedures, instruments, and data analysis for the HR executive and IT employee survey are described.

Research Design

The goal of this study was to explore both individual- and organizational-level impacts resulting from the use of IT-industry-sponsored credentials. The focus was on managers and IT employees from organizations with an internal, stand-alone IT department. The study was undertaken in two parts with (a) a sample of HR executives providing data on the organizational perceptions of IT-industry-sponsored credentials in the recruitment process, and (b) a sample of IT employees from a sub-set of the same organizations providing data on individual perceptions of IT-industry-sponsored credentials, and responses to questions that examine various work-related attitudes. The first stage involved the completion of self-administered mail surveys sent to HR executives of organizations with 500 or more employees. These respondents had previously accepted an invitation to participate in the study. The second stage of the research involved IT employees from the same organizations completing a self-administered Internet survey.

A basic problem involved in generating a sample of organizations in research of this type is the absence of a complete sampling frame (Spaeth & O'Rourke, 1994). In response, organizational researchers have often relied on non-probability sampling methods. Because no reference exists that provides the names of companies with IT departments that hire large numbers of IT employees with diverse qualifications and credentials, non-probability sampling was used in this study.

Given that the focus of this study was organizations with stand-alone IT departments, it was assumed that such departments were more likely to be associated with large organizations. Organizational size has been shown to influence both the role and prominence of IT, as well as various human resource management practices, including recruitment. More specifically, large organizations are more likely to have dedicated human resource management professionals organized into a human resource department. These professionals are more likely to be involved in the recruitment process, as compared with smaller organizations where senior managers and administrators assume the duties for recruitment (Barber, Wesson, Roberson, & Taylor, 1999).

Prior research has determined that formal hiring standards are positively related to the presence of a human resource department within an organization (Cohen & Pfeffer, 1986). According to Cohen and Pfeffer, this finding supports the proposition that human resource management professionals "have an interest in the establishment of more formal and more selective hiring standards, because that increases their role in the organization and because such practices are consistent with the idea of modern effective personnel management" (p. 5).

Large organizations have also been shown to be more concerned with objective criteria related to qualifications, academic preparation, and previous work experience (Barber, Wesson, Roberson, & Taylor, 1999). In a related finding, Cohen and Pfeffer (1986) found that the presence of a human resource management department in an organization increased the importance of educational credentials (defined in their study as a required college degree) in hiring decisions. The human resource management department, in essence, becomes the screening device to ensure that workers have the required technical skills.

Management research commonly uses the number of employees to measure organizational size. For example, studies of training in small businesses commonly use the criterion of less than 500 employees (Sadler-Smith, Sargeant, & Dawson, 1998; Wong, Marshall, Alderman, & Thwaites, 1997). Therefore, firms with 500 or more employees can be thought of as large organizations. The decision to define the population as HR executives and IT employees in large organizations was based on existing research. Literature suggests that organizational size is a major determinant of IT investment and infrastructure to support the IT function (Armstrong & Sambamurthy, 1999). Furthermore, larger rather than smaller organizations are more likely to adopt new information technologies (Pennings, 1988). As of 1999, large organizations employed about 41.9 % of private-sector workers (Headd, 2000, April). For the purpose of this study, a large organization was defined as a for-profit organization based in the United States with 500 or more employees.

Organizations were identified from the ReferenceUSA database (ReferenceUSA, 2001). This public database contains more than 12 million listings of large U.S. organizations and global organizations with offices in the United States. The database allows samples to be drawn using pre-determined parameters that match the fields of information.

Part 1—HR Executives

Population

For the current study, the population was all large organizations either U.S. owned or operating in the United States (with large organizations defined as those with 500 or more full-time employees). From the 12 million organizations listed in the ReferenceUSA database, all 3,336 organizations with 500 or more employees were selected. These organizations represent the population for this study.

All 3,336 organizations were invited to participate in this study. Following a reminder postcard sent to HR executives 2 weeks after the initial mailing, a total of 211 responses were received, with 50 returned with bad addresses, 111 declining to participate, and 50 consenting. The 50 consenting organizations represent the volunteer sample for this study.

A total of 33 of the 50 HR executives consenting to participate in the survey actually completed the survey. These 33 organizations responding from the sample of 50 represented a 66%

response rate. The 33 responding organizations represent 1% of the population of 3,336 eligible organizations.

Procedures

A personalized letter explaining the study and a postage-paid reply postcard indicating willingness to participate were mailed to both the Chief Executive Officer (CEO) and Vice President for Human Resources (HR executive, or equivalent title for the most senior executive with administrative responsibility for human resource management) at all 3,336 organizations identified for the study. Following a reminder postcard sent to HR executives 2 weeks after the initial mailing, 50 executives consented to participate in the study. These 50 HR executives subsequently received a letter describing the study, a paper-and-pencil survey, directions for returning the survey, and a postage-paid envelope.

HR Executive Instrument

The survey instrument forwarded to HR executives focused on the following key categories of variables: (a) characteristics of the organizations, (b) qualifications of IT employees, and (c) the perceived influence of industry-sponsored credentials on the recruitment process, training and development, and organizational outcomes (see Appendix A). A description of these three categories of variables is presented in the following paragraphs.

Characteristics of the organizations. This section of the instrument asked HR executives to report the number of IT employees in their organizations, the current number of vacancies, the hiring volume over the previous 12 months, and the average length of time required to hire IT employees. HR executives were also asked to identify the IT-related occupations for which they typically recruit. An existing framework that listed IT occupations was used in this study, given the widespread disagreement as to the occupational titles within the IT industry. The Minnesota High Tech Association (MHTA) (Schmidt, 2001) conducted a job analysis study of the 10 most frequently hired IT-related occupations. Using the MHTA IT-job framework, respondents were asked to identify which IT job titles they typically recruit for their company. The following 10 job titles, as identified by the MHTA job analysis study, were used.

- Data/Database Administrator
- Network Administrator
- Programmer Analyst
- Software Engineer
- Technical Communications Specialist
- Technical Sales Person
- Technical Support/Help Desk Assistant
- Telecommunications Specialist
- Quality Assurance Engineer
- Webmaster

Qualifications of IT employees. This section of the instrument solicited information from HR executives to identify the desired qualifications of applicants for non-managerial IT positions, and the IT-industry-sponsored and non-IT-industry-sponsored credentials of current employees in their organizations. HR executives were also asked their opinions on the potential influence of different educational qualifications (college degrees and IT-industry-sponsored credentials) on recruitment and subsequent on-the-job learning. Furthermore, HR executives were asked a series of questions to examine if different qualifications might influence the work-related attitudes of their IT employees. Respondents were asked to compare IT employees with college degrees with IT employees without college degrees in terms of their success in being recruited, their motivation and participation in training, and their attitude on the job.

Perceived influence of industry-sponsored credentials on the recruitment process. In this section of the instrument, HR executives were asked to indicate the perceived influence of IT-industry-sponsored credentials on the recruitment process with respect to the following variables: (a) cost of recruitment, (b) ease of recruitment, (c) efficiency of recruitment, and (d) ability to identify applicant level of knowledge, skills, and abilities.

Perceived influence of industry-sponsored credentials on training and development. In this section of the instrument, HR executives were asked to respond to two questions on the training costs and time taken for employees to learn new jobs, and two items on career development. HR executives were also asked to respond to a series of questions about their on-going training and development policies and practices.

Perceived influence of industry-sponsored credentials on organizational outcomes. In this section, a series of questions was asked to gauge HR executives' perceptions of the influence of IT-industry-sponsored credentials on organizational outcomes: (a) theoretical understanding of IT products, networks, and customer needs; (b) creative problem solving abilities; (c) teamwork and IT employees' camaraderie; and (d) turnover.

Data Analysis

Descriptive statistics were used to analyze responses to the HR executive survey. The low number of responses prevented additional types of analysis.

Part 2—IT Employees

Population

The population for the IT employee survey was all the IT employees in the 3,336 companies that employ 500 or more employees. It is impossible to calculate the exact size of this population because the total number of IT employees in these organizations was unavailable. All IT employees at the 50 organizations that received an HR executive survey were invited to participate in this study. At the conclusion of the study period, a total of 245 completed surveys from IT employees was received. These 245 employees were from 13 organizations employing a total of 13,326 IT workers. The responses of an additional 120 IT employees were excluded due

to incomplete surveys. These respondents visited the website hosting the survey but did not complete more than 5% of the instrument. It is impossible to calculate the response rate of IT workers, because it is unknown how many IT employees in each organization received the e-mail invitation from the executives in these organizations (VP of HR, or Chief Information Officer) who had the responsibility of contacting their IT employees.

Procedures

The mailing of a paper-and-pencil survey to HR executives corresponded with the sending of an electronic mail message to the HR executives or their designees. The electronic mail requested the HR executives or their designees to forward information regarding study participation to all full-time IT employees of the organization. The forwarding information to IT employees contained introductory information regarding the web survey and the Uniform Resource Locator (URL) link to the Internet survey site. The first page that IT employee respondents accessed was an introduction page (Appendix B). This web page introduced the survey goals, described the web-based data collection procedures, and determined the eligibility of respondents. The introduction page for IT workers contained three questions. The first question was designed to determine if respondents were employees in the IT industry. Respondents who indicated that they were not IT employees received an on-screen message indicating that they were ineligible to complete additional questions. The second question on the introduction page asked employees to respond to the statement that industry-sponsored IT credentials are important to their career success. A 5-point Likert-type scale with anchors 1 = strongly agree and 5 = strongly disagree was provided. The final section asked respondents to state how many industry-sponsored credentials they had. The response categories were: 0, 1, 2, 3, 4, and five or more.

At the completion of these three questions, respondents were provided with additional information about the purpose and layout of the main survey, and they were asked to become participants in the study. Respondents were asked to insert their company e-mail address into a text box located at the bottom of the page. This information was requested to provide an authentication process to ensure that responding IT employees were from an organization with a participating HR executive. Upon receipt of this information, an e-mail was automatically generated by the hosting computer and sent to the respondents, providing them an access code to the IT employee survey (Appendix C).

IT Employee Instrument

IT employees were asked to identify selected demographic information; the type of qualifications they hold; their attitudes toward IT-industry-sponsored credentials as those credentials influence recruitment, training, turnover, and career success; and their work-related attitudes. The survey was comprised of previously validated and reliable items to measure five of the work-related attitude variables in this study. The following discussion outlines the items associated with each of the variables.

Demographic information. This section of the instrument asked IT employees to answer a series of questions about their background: (a) their gender, (b) the number of years they have been employed at their current organizations, and (c) the length of their employment in the IT field. The highest level of educational achievement was measured with response options ranging from high-school diploma to doctoral degree. Job and organizational tenure were measured by asking employees to indicate the number of years they have been employed in the IT or computer industry, and the number of years they have been employed in their current organization.

Types of IT qualifications. In this section of the instrument, IT employees were asked to identify the numbers and types of IT-industry-sponsored credentials they held, as well as the number and types of credentials that were not IT-industry-sponsored.

Perceived influences of industry-sponsored credentials. This section of the instrument asked IT employees to identify factors related to their attitudes toward the perceived influence of IT-industry-sponsored credentials in terms of (a) recruitment, (b) training and development, and (c) selected organizational outcomes.

Work-related attitudes. IT employees were asked to indicate their work-related attitudes on a number of variables: (a) motivation to transfer learning, (b) perceived access to training, (c) organizational commitment, (d) job satisfaction, and (e) turnover intentions.

Motivation to transfer learning. This section of the study contained a 4-item scale based on Seyler, Holton, Bates, Burnett, and Carvolho (1998). Motivation to transfer learning was measured on a 5-point rating scale, with response categories ranging from "strongly disagree" through "neutral" to "strongly agree." Examples of the items are: "I believe training will help me to do my job better," and "I get excited when I think about trying to use my new learning on the job."

Perceived access to training. Perceived access to training was measured by three items on a 7-point Likert-type scale. The first two items were related to the respondents' knowledge of their organizations' policies and standards toward the provision of training. The item to determine the amount of knowledge employees had about the existence of training policies read, "My organization has stated policies and standards on the amount of training I am to receive each year." The item to determine the employees' familiarity with training policies read, "I am familiar with my organizations' policies and standards of the amount of training I am to receive." Both items, adapted from Tharenou and Conroy (1994), were measured on a 7-point Likert-type scale anchored with "strongly disagree" and "strongly agree" labels. The third item in the access-to-training scale was a researcher-developed item that was also measured on a 7-point Likert-type scale anchored with "strongly disagree" and "strongly agree" labels. This item sought the level of agreement or disagreement with the following statement: "The organization provides access to training."

Organizational commitment. The affective organizational commitment subscale from the Affective, Continuance, and Normative Commitment Scales (ACNCS) of Allen and Meyer (1990) was used to measure organizational commitment. The ACNCS is composed of 19 items grouped into three subscales that measure the affective, continuance, and normative forms of organizational commitment. Only the 6-item affective subscale was used in this study because it consistently produces the strongest measure of employee attachment among the three forms of commitment (Meyer & Allen, 1997). This study utilized the 7-point scale, with anchors "strongly disagree" to "strongly agree," as developed by Allen and Meyer (1990). Example items include: "This organization has a great deal of personal meaning for me," and "I really feel that this organization's problems are my own." Meyer and Allen (1997) reported the median reliability score for the affective subscale to be .85.

Job satisfaction. Job satisfaction can be measured with a number of different instruments (Spector, 1997). In the interest of overall instrument length, the 3-item Michigan Organizational Assessment Questionnaire Subscale for job satisfaction was used. The items are: "All in all I am satisfied with my job," " In general, I don't like my job," and "In general, I like working here." Responses were made on a 7-point scale with anchors labeled as "strongly disagree" and "strongly agree." The three items are summed to provide an overall job satisfaction score (Spector, 1997).

Turnover intentions. Turnover intentions were measured with three items adapted from Irving, Coleman, and Cooper (1997) research. Original items included in their scale are, "I intend to stay in this job for the foreseeable future," "I will probably look for a new job within the next year," and "I do not intend to pursue alternative employment in the foreseeable future." These were adapted for this study to: "I intend to change jobs within this firm in the foreseeable future," "I intend to seek work in another profession other than IT in the foreseeable future," and "I intend to seek IT related work at another firm in the foreseeable future." Responses to these items were on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree).

Validation

Validation procedures involved initial consultation with three experienced researchers to determine the content validity of all survey items, with particular emphasis on the newly created or adapted items. Feedback indicated that statistical validation procedures and results from items used previously were acceptable. Additionally, the new items were affirmed as appropriate for answering the research objectives.

Following the review by researchers, three HR executives and five IT employees were asked to review the instrument. All feedback was affirmative except for concerns about the use of two different Likert-type scales. Researchers were consulted regarding this concern. It was determined that in order to build upon existing research and create ease for other researchers interested in these measures, the same numerical levels as the originally published Likert-type scale should be used.

Data Analysis

Analysis of the survey results used the Statistical Package for the Social Sciences (SPSS). The data from IT employees were collected on-line, with responses saved in a database. These were then exported into Microsoft Excel™ prior to being transferred into SPSS. Given the difficulty of asking open-ended questions with on-line surveys, the majority of data was ordinal and interval, and was collected using Likert-type scales. A pull-down menu of responses in years was provided for items such as "number of years employed in the IT industry." One of the benefits of the on-line data collection method used in this study was the infrequency of missing data. In the few instances of missing data, analysis was conducted with the number of completed responses.

Correlation measures. Pearson's correlation coefficient was used to determine the relationships among the variables under examination. Because of the possibility for the correlation to be either positive or negative, a two-tailed test was used.

Internal consistency of measures. Cronbach's Alpha was used as the measure of reliability in order to determine the level of consistency among items associated with each variable.

Web-Based Data Collection

For the past decade, the Internet's rapid growth and widespread use among the mainstream population make web surveys an efficacious means of survey research. Internet use has grown at an explosive rate; for example, one industry report predicted that the United States will grow to over 207 million Internet users by 2005, from 76.5 million users in 1998—thereby creating enormous potential to reach large and diverse segments of the population (Paquet, 1999). Several researchers (Couper, 2000; Kaye & Johnson, 1999; Weible & Wallace, 1998, Fall) have suggested four major advantages of employing web-based surveys in research. These are (a) time efficiency in terms of response and data generation, (b) reliable and verifiable delivery, (c) flexibility and relatively easy updating, and (d) cost-savings in creating and administering surveys. Another major potential advantage is the enhanced response quality in web surveys, due to the lack of social context information and personal interactions, which have been shown to introduce response-bias in other survey techniques (Couper; Kaye & Johnson; Sproull, 1986). As a consequence, respondents tend to reveal their honest opinions, and even extreme views, without the presence of social pressure—thereby reducing social desirability and impression management frequently plaguing survey results (Sproull).

One of the most appealing merits of web surveys is time- and cost-efficiency of survey administration. Recent research found that web-based questionnaires, compared with mail surveys, were about 3 times faster in generating responses, 4 times cheaper to create and update, and 3 times cheaper to code and analyze (Weible & Wallace, 1998, Fall). However, along with the benefits, web surveys also engender potential disadvantages to survey researchers.

One of the widely discussed limitations is generalizability of web survey findings because they frequently rely on purposive sampling rather than random sampling. For instance, access to

the Internet is limited to only those who use the technology, which can lead to coverage error and non-representativeness of samples in web surveys, while limiting inferences made to the population as a whole (Couper, 2000). Couper extensively discussed the sampling issues associated with "coverage error," a term used to describe the mismatch between a target population and a sample. According to Couper, the Internet population is systematically different from the general population in both demographic and non-demographic characteristics, thereby affecting the validity of survey findings. In light of Couper's argument, this study is intended to limit generalization to a restricted population— IT employees in large U.S. organizations with 500 or more employees. Considering the strengths and shortcomings of various survey modes, the web survey method was thought to be uniquely suited for the targeted audience of IT employees, due to their technological proficiency and the amount of time they spend on computers.

Another disadvantage often associated with web surveys is the problem of low response rates (Sproull, 1986). A number of studies indicate that a lack of social and personal presence in the administration of web surveys often negatively affects response rates (Penkoff, Colman, & Katzman, 1996). For example, hostile responses may be encountered when researchers electronically send surveys to unsolicited people without advance notification. Babbie (1990) further argued that electronic surveys should simplify and reduce procedural steps involving completion in order to boost response rates. The more procedural steps potential respondents have to follow, the less likely they are to complete surveys. Kaye and Johnson (1999) also noted that potential respondents might be more inclined to participate in a survey if access to the instrument is available through a direct URL link to the survey site.

To address potential weaknesses of web surveys, this study was designed to develop cooperative relations with potential respondents. For instance, introductory letters explaining the intent of the study and seeking voluntary participation preceded the distribution of the web survey. Furthermore, a direct URL link to the survey web site was e-mailed to participants in an attempt to encourage their responses. Participants were also required to enter access codes to get onto the survey site, to prevent them from completing the survey multiple times.

Existing research has shown that web survey design and technical difficulties might discourage potential respondents from survey participation. For example, browser-based design flaws, unreliable connections, slow download time, and text and graphic distortions are a few of the design and technical issues that deter people from participating in web-based surveys. By designing a web survey instrument that is easy to follow and understand, measurement error can be greatly reduced (Couper, 2000). Therefore, in order to reduce design and technical problems, the web survey in this study was designed and administered by an outside commercial vendor with considerable expertise in creating and administering web surveys. The web survey instrument was carefully designed to be concise and have no graphics, thereby reducing download time and format distortions. In addition, the estimated completion time of 12 minutes was mentioned frequently in pre-survey communication and displayed prominently at the top of the survey in order to encourage respondents to complete the survey.

Although a number of on-going technical issues and caveats must be addressed, existing research clearly indicates that web-based surveys can be effective research tools. Web-based

surveys can provide survey researchers with unprecedented opportunities to reach and explore diverse segments of the population in a timely and cost-efficient manner. Furthermore, with the development of new and more-user-friendly software products, researchers find the Internet increasingly easier to incorporate in the survey research process (Weible & Wallace, 1998).

With respect to the IT employee survey, as previously mentioned, the survey was designed, administered, and maintained by an external consultant with web survey expertise. Upon completion of the survey, IT employees electronically submitted their individual responses to the database. A consultant managed the database for this project. The consultant forwarded on-going results to the research team on a weekly basis. The web site containing the IT employee survey closed on September 15, 2001.

Limitations

The results of this research should be interpreted with recognition of the limitations and, therefore, the generalizability of this study. The principal limitation of this study is the low response rate obtained from both the HR executives and IT employees. The research design potentially contributed to the poor response rate by seeking a commitment from HR executives prior to the sending of the questionnaires. However, the response rate from those organizations that did agree to participate is at or above the levels generally considered acceptable for this type of research. Yet, it must be acknowledged that the response rate places a serious limitation on the generalizability beyond the organizations studied. The low response rate from the IT employee survey was perhaps partly attributed to the web-based data collection procedure. The still-evolving nature of web-based surveys highlighted many issues that are believed to have influenced the number of respondents in this study. For example, the authentication process required that respondents use their official company e-mail addresses, which might have resulted in some employees being concerned about issues of confidentiality. Furthermore, the technology potentially influenced the number of respondents; server crashes, virus attacks, and power outages all were responsible for taking the survey off-line for brief periods of time, even though efforts were made to minimize periods in which the survey was off-line. An e-mail was sent to those HR executives and IT employees who experienced access difficulties, apologizing for the inconvenience and informing respondents that the situation was rectified.

The generalizability of the results is limited to the degree to which other populations resemble the one studied. Furthermore, the lack of definition of the term "IT employee" could have caused confusion given the well-documented difficulties in defining the boundaries of occupations within the IT industry. The sample was also limited by the degree to which the ReferenceUSA database provided correct information. Based on the number of returned surveys (for incorrect addresses), some concern can be leveled at the accuracy of the database used in the study.

The survey nature of this study introduces limitations that are inherent in this research design. These include possible ambiguity of individual questions, answers that cannot be clarified, memory lapses, variations in individual motivation to partake in the survey, and variations in the knowledge of respondents. These are noted as being especially relevant for

studies of perceptions of work-related practices (Schneider, Ashworth, Higgs, & Carr, 1996). The concern that all measures were gathered from the same source in a single questionnaire raises concerns of common method variance, although Crampton and Wagner (1994) concluded that this issue is less problematic in organizational behavior research than previously thought. More objective measures of actual practices and criteria used in the recruitment process and of employee job behavior would serve to verify the influence of various industry-sponsored credentials on recruitment, and their relationship to workplace attitudes.

RESULTS

The results presented here are divided into three parts. The first part reports on the results from the HR executive survey analysis, the second part reports on the results from the analysis of the IT employee survey, and the third part reports on comparisons between IT employees with and without IT-industry-sponsored credentials.

HR Executive Survey Results

Findings from the 33 completed surveys from HR executives are divided into the following three sections: characteristics of the organizations, qualifications of IT employees, and the perceived influence of qualifications.

Characteristics of the Organizations

HR executives were asked to provide information on the number of IT employees in their organizations, number of current IT-related vacancies, number of IT employees hired in the last year, and the time taken to hire new IT employees. The average number of employees in the organizations represented by HR executive respondents was 423. The mean number of current IT-related vacancies in these organizations was 4.8, and the mean number of IT employees hired over the past year was 50.7. According to the HR executives, it takes an average of 7.5 weeks to hire a new IT employee. HR executives were asked to report on the types of IT jobs that are typically posted in their organizations, based on a list of IT occupations provided in the survey. Responses to this question were widely spread over the spectrum of IT jobs, and no specific pattern was discernable. Given the modest number of respondents to this survey, it is not possible to report these responses in a meaningful way.

To assess the characteristics of the organizations, a series of questions was asked using a 5-point scale with anchors of 1 being "strongly disagree" and 5 being "strongly agree." The responses indicated that, overall, organizations provide a fairly high level of training and development opportunities to their employees. Nearly half the respondents (42.4%, $n = 14$), with a mean of 3.36, indicated a 4 or 5 on the statement that their organizations require employees to maintain their IT-related certification. A majority of respondents (75.7%, $n = 25$) indicated a 4 or 5 on the statement that their organizations encourage participation in in-house training and development, while 84.9% ($n = 28$) gave the same ratings on the statement that employees were encouraged to participate in externally provided training and development. The means for these two statements were 3.94 and 4.18, respectively.

With a mean of 3.85, two thirds of HR executives (66.7%, $n = 22$) indicted a 4 or 5 on the statement that their organizations provided funding for IT certification programs facilitated by an outside vendor. Eighty-five percent of respondents (84.9% $n = 28$, mean = 4.30) also gave the same ratings to the statement that their organizations actively support employee learning. Less than a quarter of the respondents (21.3%, $n = 7$) indicated a 4 or 5 on the statement that their organizations had stated policies about the amount of training that they offered for their IT

employees. Likewise, only 27.3% (n = 9) of respondents gave a 4 or 5 rating on the statement that they had stated policies on the type of training for their IT employees.

Qualifications of IT Employees

HR executives were asked questions related to the types of qualifications desired in applicants for non-managerial IT positions. The qualifications of current employees were explored, along with the perceptions of HR executives toward the influence of IT-industry-sponsored credentials, and as compared to other qualifications in terms of recruitment, learning, and work-related attitudes.

Desired qualifications of non-managerial IT applicants. HR executives were asked to indicate the type of qualifications they would like in applicants for IT jobs. Table 2 reports the item mean and the percentage of respondents, ranking each type of qualification on a 5-point scale, with anchors of 1 being "not at all important" and 5 being "very important."

Table 2

Importance of Qualifications in Hiring Decisions for Non-Managerial IT Applicants

Type of qualification	Mean	Percentage of respondents indicating either 4 or 5*
High-school diploma	4.79	97.0
2-year college degree	4.16	71.0
4-year undergraduate degree in IT-related filed	3.88	63.6
4-year undergraduate degree in non-IT-related field	2.90	25.0
Master's degree in IT-related field	2.41	15.6
Master's degree in non-IT-related field	2.06	3.2
IT-industry-sponsored credentials	3.63	62.5

Note. * Five-point scale with anchors 1 = not at all important; 5 = very important.

With a mean of 3.63, a large number of respondents (62.5%, n = 20) rated IT-industry-sponsored credentials as being important to their non-managerial-level IT employee hiring decisions.

Over two thirds of the respondents (66.7%, n = 22) revealed that they specify IT-industry-sponsored certificates or credentials for certain IT positions. Very few firms expect applicants to have only industry-sponsored credentials as evidenced by the high percentage (81.3%, n = 26) of HR executives who stated their firms do not have IT jobs requiring industry-sponsored credentials as the only prerequisite qualification. The reverse of this is that 19.7% (n = 7) of the

HR executives work for organizations where certain IT jobs require potential applicants to hold only a relevant IT-industry-sponsored credential.

As can be seen in Table 2, the overwhelming majority of respondents (97%, $n = 32$) indicated that a high-school diploma was the minimal credential for obtaining work in the IT field. The mean for this type of desired qualification was 4.79. Two-year college degrees were also considered very important by nearly half of respondents (45.5%, $n = 15$), with a mean of 4.16. Almost two thirds of respondents (63.6%, $n = 21$) gave a rating of 4 or 5 on the statement that 4-year undergraduate degrees in IT-related fields, such as computer science, math, or technology, were important or very important to IT employee hiring decisions. Only 9.1% ($n = 3$, mean = 2.90) indicated that 4-year undergraduate degrees unrelated to IT were very important.

Master's degrees or above in computer science, math, or technology were considered to be less crucial in the decision to hire IT employees. For example, with a mean of 2.41, only 15.6% ($n = 5$) of respondents gave a rating of 4 on the statement that such advanced degrees are important in their IT employee hiring decisions. Similarly, only 3.2% ($n = 1$) indicated a 4 on the statement that advanced degrees unrelated to IT are important in IT employee hiring decisions.

Based on their ability to hire IT workers, almost half (48.5%, $n = 16$) of the respondents agreed that the predicted shortage of IT workers appeared to be accurate, whereas the remaining respondents (51.5%, $n = 17$) indicated that the predicted shortage was not accurate. Respondents were asked to estimate the percentage of IT applicants responding to job announcement advertisements who have the desired credentials. All but one HR executive answered this question with the responses ranging from a low of 5% to a high of 95%. According to HR executives who responded, 56.1% of IT applicants can be expected to have the credentials desired for the job being advertised.

Educational Qualifications of Current IT Employees. To assess the educational qualifications of their current IT workforce, HR executives were asked to estimate the percentage of IT employees in their organizations who hold different types of credentials and qualifications. Responses are reported in Table 3. HR executives indicated that over half (53.4%) of their IT employees had 4-year undergraduate degrees in computer science, math, or technology, and 39.9% had 2-year college degrees. Over one fifth of the IT workforce (21.5%) was reported to have 4-year undergraduate degrees unrelated to IT. Only 9.4% of IT employees had master's degrees or above in fields related to IT, and an even smaller number (6.0%) had master's degrees or above unrelated to IT.

Of special interest to this study was the number of current IT employees with IT-industry-sponsored credentials. According to the HR executives, 47.1% of their current IT workforces has industry-sponsored credentials. A large number of respondents (84.8%, $n = 28$) noted an increasing number of job applicants with industry-sponsored credentials were responding to IT job advertisements.

Table 3
Educational Qualifications of Current IT Employees

Type of qualification	Mean percentage
2-year college degree	39.9
4-year undergraduate degree in IT-related filed	53.4
4-year undergraduate degree in non-IT-related field	21.5
Master's degree in IT-related field	9.4
Master's degree in non-IT-related field	6.0
IT-industry-sponsored credentials or certificates	47.1

Comparing IT employees with and without college degrees. To determine how IT employees with college degrees compared to those without college degrees, HR executives were asked to rate their levels of agreement on a series of statements. HR executives' perceptions were examined by a 5-point scale, with anchors of 1 being "not at all important" and 5 being "very important." Overall, HR executives view IT employees with college degrees more favorably than those without college degrees. A majority of respondents (84%, $n = 28$, mean = 4.24) gave either a 4 or 5 on the statement that IT employees with college degrees were more likely to receive multiple job offers. Likewise, 78.7% ($n = 26$) of HR executives gave a rating of 4 or 5 on the statement that college graduates were more likely to be hired, with the mean of 4.03. Over three fourths of respondents (81.8%, $n = 27$) also indicated a 4 or 5 on the statement that college graduates were likely to be paid more; the mean for this statement was 4.15. College graduates were also considered more likely to aspire to management or administrative positions. With a mean of 4.03, a large number of respondents (75.8%, $n = 25$) gave a rating of 4 or 5 on this prediction. Slightly more than half the respondents (51.5%, $n = 17$, mean = 3.52) also indicated a 4 or 5 on the statement that college graduates were more likely to have successful IT careers.

Table 4
Comparison of IT Employees With and Without College Degrees

Compared with IT employees without college degrees, IT employees with college degrees are more likely to	**Mean**
Get multiple job offers	4.24
Be hired	4.03
Be paid more	4.15
Aspire to management or administrative positions	4.15
Have successful IT careers	3.52
Be productive	3.06
Be motivated to learn	3.36
Participate in externally provided training and development	3.73
Participate in in-house training and development	3.61
Be motivated to transfer learning	2.36
Be committed to the organization	2.64
Attend work (less likely to be absent)	2.64
Be satisfied in their job	
Turn over	3.24

Note. * Five-point scale with anchors 1 = strongly disagree; 5 = strongly agree.

College graduates were identified as more productive, more involved in their learning and development, and more likely to transfer their learning to the job setting. A majority of respondents (84.9%, n = 28, mean = 3.06) gave either a 4 or 5 on the statement that college graduates were more productive than IT employees without college degrees. Further, with a mean of 3.36, nearly half the respondents (48.5%, n = 16) indicated a 4 or 5 on the statement that college graduates were more motivated to learn. A majority of respondents (69.7%, n = 23, mean = 3.73) gave a rating of 4 or 5 on the statement that college graduates were more likely to participate in externally provided training and development, and two thirds of the respondents (66.7%, n = 22, mean = 3.61) indicated a 4 or 5 on the statement that college graduates were more likely to participate in in-house training and development. Less than one quarter of the respondents (24.2%, n = 8, mean = 2.36) strongly disagreed with the statement that employees with college degrees were less likely to transfer what they learned into their practices at work.

According to HR executives, IT employees with college degrees were more committed to the organization (mean = 2.64) and less likely to be absent, as compared to IT employees without college degrees (mean = 2.64).

Job satisfaction does not appear to be related to the type of qualification held by IT employees, as HR executives indicated that those with a college degree are no more likely to be satisfied in their job, as compared to those employees without a college degree (mean = 2.97). In response to the statement that college graduates were more likely to leave the organization, the majority of HR executives agreed (mean = 3.24), suggesting that turnover is more likely from IT employees with a college degree, as compared to those IT employees without a college degree

Perceived Influence of Qualifications

The potential influence of qualifications was explored by examining the perceptions of HR executives as to how IT-industry-sponsored credentials may influence recruitment, training and development, and selected organizational outcomes. These findings are reported in Table 5.

Table 5

HR Executives' Perceptions of the Influence of IT-Industry-Sponsored Credentials on Recruitment, Training and Development, and Organizational Outcomes

Variable	Mean	Percentage of respondents indicating either 4 or 5*
Recruitment		
Increase ease of identifying applicant knowledge, skills, and abilities	3.82	78.8
Make recruitment process easier	3.45	54.6
Make recruitment process more time-efficient	3.39	51.5
Reduce cost of recruitment	3.03	39.4
Training and development		
Reduce training costs for IT workers	3.41	53.2
Reduce the amount of time for learning jobs	3.39	48.5
Increase the chance of success for new employees	3.52	48.5
Organizational outcomes		
Improve theoretical understanding of IT products, networks, and customer needs	3.55	54.6
Improve an employee's ability to creati[illegible] solve problems	3.30	39.4
Promote teamwork and camaraderie among IT employees	2.91	21.3
Reduce the likelihood of turnover	2.66	18.7

Note. * Five-point scale with anchors 1 = strongly disagree; 5 = strongly agree.

Recruitment. Given the increasing number of IT employees with IT-industry-sponsored credentials, it would be logical to assume that these credentials influence the recruitment process. To determine the extent to which credentials influence the recruitment processes, respondents were asked to rate their agreement on a series of statements regarding the ease, cost, and time-efficiency of recruitment.

Based on the responses, the greatest benefit of credentials was that they allow organizations to more easily identify an applicant's skills, knowledge, and abilities. More than three quarters of respondents (78.8%, $n = 26$) either agreed or strongly agreed, with a mean of 3.82, that industry-sponsored credentials make it easier to identify applicants' knowledge, skills, and abilities. More than half the respondents (54.6%, $n = 19$), with a mean of 3.45, either agreed or strongly agreed that industry-sponsored credentials make the recruitment process easier. More than half the respondents (51.5%, $n = 17$) also either agreed or strongly agreed that credentials make recruitment more time-efficient. Respondents indicated that IT-industry-sponsored credentials did not necessarily reduce the cost of recruitment. With a mean of 3.03, only 39.4% ($n = 13$) either agreed or strongly agreed that credentials reduced the cost of recruitment. An almost equal number of respondents (36.4%, $n = 12$) either strongly disagreed or disagreed that credentials reduce the cost of recruitment.

Training and development. IT-industry-sponsored credentials appear to have a somewhat positive impact on training and development. Half the respondents (53.2%, $n = 17$, mean = 3.41) agreed or strongly agreed that industry-sponsored credentials reduce the training costs for IT workers, while 48.5% ($n = 16$, mean = 3.39) either agreed or strongly agreed that credentials were likely to reduce the amount of time for new employees to learn their jobs. Nearly half the respondents (48.5%, $n = 16$, mean = 3.52) either agreed or strongly agreed that industry-sponsored credentials increase the chance of success for new employees.

Organizational outcomes. A series of potential organizational outcomes that might be influenced by the type of qualification held by applicants was explored. More than half the respondents (54.6%, $n = 18$, mean = 3.55) agreed or strongly agreed that credentials improved theoretical understanding of IT products, networks, and customer needs. Far less support was found for the statement that IT-industry-sponsored credentials improve an employee's ability to creatively solve problems. Only 39.4% of respondents ($n = 13$, mean = 3.30) either agreed or strongly agreed with this potential outcome. Less than a quarter of respondents (21.3%, $n = 7$) either agreed or strongly agreed that industry-sponsored credentials promote teamwork and camaraderie among their IT employees, compared to 11 respondents who disagreed or strongly disagreed with this statement. Almost half the respondents (45.5%, $n = 15$, mean = 2.91) gave this item a rating of 3 on a 5-point scale, indicating that this type of qualification is unlikely to influence the promotion of attitudes or behaviors related to camaraderie and teamwork among IT employees.

The issue of turnover was explored with a second question that asked HR executives if they believed that industry-sponsored credentials reduce the likelihood of turnover. With a mean of 2.66, only 18.7% of respondents ($n = 6$) either agreed or strongly agreed that credentials reduce the likelihood of turnover. Almost half the respondents (46.9%, $n = 15$) either strongly disagreed

or disagreed with this statement. This suggests that HR executives tend to feel that employees with IT-industry-sponsored credentials are more likely to leave the organization, as compared to employees without industry-sponsored credentials.

IT Employee Survey Results

The following section reports results from the 245 completed surveys from IT employees. This section is divided into four parts: (a) background; (b) type of qualifications; and perceived influence of industry-sponsored credentials on recruitment, training and development, and organizational outcomes; and (c) work-related attitudes of IT employees.

Background

The 245 responding IT workers were employed in a full-time capacity at 13 of the 33 organizations from which completed HR executive surveys were received. These 13 organizations were located in large cities and towns throughout the United States.

Gender. Almost 90% (89.8%, n = 220) of respondents were male, reflecting the well-documented under-representation of women in the IT industry. Because the respondents were overwhelmingly male, the relationship of gender with other variables in this study was not explored.

Organizational tenure and IT industry tenure. Organizational and job tenure measures indicated that the majority of respondents had been with their current organization for several years and were not new to the IT industry (see Table 6). The mean number of years employed at the current organization was 7.3 years, with a mean of 10.3 years of employment within the IT industry. A little more than one in four respondents (27.2%, n = 46) were with their current organization for a period of less than one year. An additional 26.1% (n = 44) had been employed for 2 to 3 years, and a further 10% (n = 17) for 4 to 5 years. Seventeen employees (10.2%) had been employed with their current employer for 6 to 10 years, 8 employees (4.8%) for 11 to15 years, 14 (8.4%) for 16 to 20 years, and 23 (13.6%) for 21 or more years.

Less than 5% (4.9%, n = 12) of the employees were in their first year of employment within the IT industry. An additional 25 employees (16.2%) were in either their second or third year in the industry, with a further 17 employees (11%) in their fourth or fifth year. Almost one quarter of respondents (24.6%, n = 38) were in the 6–10-year range of job tenure within the industry, 12.8% (n = 20) were in the 11–15-year range, 11.6% (n = 18) in the 16–20-year range, and 15.6% (n = 24) had been employed for more than 20 years.

Table 6
Organizational Tenure and IT-Industry Tenure

Tenure	Mean	Percentage
Organization tenure		
Years of employment at the current organization	7.3	
Less than one year		27.2
2 to 3 years		26.1
4 to 5 years		10.0
6 to 10 years		10.2
11 to 15 years		4.8
16 to 20 years		13.6
More than 20 years		9.4
IT-industry tenure		
Years of employment within the IT industry	10.3	
Less than one year		4.9
2 to 3 years		16.2
4 to 5 years		11.0
6 to 10 years		24.6
11 to 15 years		12.8
16 to 20 years		11.6
More than 20 years		15.6

Type of Qualifications

The type of qualification held by current IT employees was explored, along with the following two dimensions. First, respondents were asked questions related to the number and type of IT-industry-sponsored credentials they held. Second, respondents were asked questions related to the highest level of education they had attained.

IT-industry-sponsored credentials. The 245 respondents were all aware of IT-industry-sponsored credentials, and nearly 70% (69.4%) of respondents indicated that they had earned one or more IT-industry-sponsored credentials (see Table 7). It should be noted that data for the number of IT-industry-sponsored credentials were generated from an item in the introductory section of the IT employee survey.

Table 7
IT Credentials per IT Employee

Number of IT-industry-sponsored credentials	Frequency	Percentage	Cumulative percentage
0	75	30.6	30.6
1	75	30.6	61.2
2	38	15.5	76.7
3	16	6.5	83.3
4	9	3.7	86.9
5 or more	32	13.1	100.0
Total	245	100.0	

The providers of the various certifications earned by respondents were explored using the top 12 IT-certification providers previously identified in a study by Adelman (2000). Table 8 reports the frequencies of the providers of the industry-sponsored credentials held by respondents. The 245 respondents in the study held a total of 406 IT certifications.

Table 8
IT Employee Certifications by Certification Provider

Provider of IT Certification	Frequency of Certifications
CompTIA	114
Dell	71
Hewlett Packard	66
Microsoft	50
IBM	21
Novell	20
Institute for Certification of Computing Professionals	7
Oracle	6
Sun Microsystems	3
Certified Internet Webmaster	0
Other, including Baan, Synbase, SAP, Adobe	48
Total	406

Note. These 406 industry-sponsored credentials were held by the 245 IT employee respondents.

Formal education credentials. One third of respondents had either a 4-year college degree or a master's degree (34%, $n = 62$). Only 5.3% ($n = 13$) of the respondents had a high-school diploma as their highest formal education qualification. The largest-reported highest level of education for IT employee respondents (38.5%, $n = 94$) was some college or formal training. The attainment of a 2-year associate's degree was the highest level of education for 22.1% ($n = 54$), a 4-year college degree for 25.4% ($n = 62$), and a master's degree for 8.6% ($n = 21$). None of the respondents held a doctoral degree (see Table 9).

Table 9
Highest Level of Education Completed by IT Employees

Credentials	Frequency	Percentage	Cumulative percentage
High School	13	5.3	5.3
Some College or Formal Training	94	38.4	43.9
2-year Associate's Degree	54	22.0	66.0
4-year College Degree	62	25.3	91.4
Master's Degree or above	21	8.6	100.0
Missing	1	.4	
Total	245	100.0	100.0

Perceived Influences of IT-Industry-Sponsored Credentials

Respondents from the IT-employee sample were asked the same questions as the HR executives, in terms of the perceived influence of IT-industry-sponsored credentials on recruitment, training and development, and organizational outcomes. These results are reported in Table 10.

Table 10

IT Employees' Perceptions of the Influence of IT-Industry-Sponsored Credentials on Recruitment, Training and Development, and Organizational Outcomes

Variable	Mean	Percentage of respondents indicating either 4 or 5*
Recruitment		
Determine the needed knowledge and skills for IT jobs	3.51	61.2
Increase the ease of identifying applicant knowledge and skills	3.58	64.1
Make recruitment process easier	3.60	61.5
Make recruitment process more time-efficient	3.50	55.1
Reduce cost of recruitment	3.30	40.0
Training and development		
Reduce training costs for IT workers	3.18	43.6
Reduce time for a new employee to learn job	3.30	49.8
Increase the chance of success for new employees	3.64	62.0
IT credentials important to career success	3.90	73.5
Organizational outcomes		
Improve theoretical understanding of IT products, networks, and customer needs	2.32	12.3
Improve an employee's ability to creatively solve problems	3.10	38.8
Promote teamwork and camaraderie among IT employees	2.87	25.7
Reduce the likelihood of turnover	2.50	51.8

Note. * Five-point scale with anchors 1 = strongly disagree; 5 = strongly agree. $N = 245$.

Recruitment. One of the often-cited benefits of credentials has been their role in determining the standards for the skills required for a specific job. This reported benefit was examined by asking respondents two questions. The first question examined respondents' level of agreement that industry-sponsored credentials determine the needed knowledge and skills for IT jobs. The mean was 3.51 on a 5-point scale with 61.2% ($n = 150$) either somewhat or strongly agreeing with the statement. Less than one fifth (18.7%, $n = 46$) either strongly or somewhat disagreed. A

related second question addressed the notion that industry-sponsored credentials make it easier to identify applicants' knowledge and skills. A similar level of agreement, as compared to the previous question, was found with 64.1% (n = 157, mean = 3.58) of respondents indicating that they either somewhat or strongly agreed, and 19.1% (n = 47) disagreed.

To determine if certification had an impact on recruitment processes, respondents were asked three questions regarding the cost, ease, and time-efficiency of recruitment. Respondents stated their levels of agreement on a 5-point scale, with anchors of 1 being "strongly disagree" and 5 being "strongly agree." In responding to the statement that certification makes the recruitment process easier, the mean was 3.6, with 61.5% (n = 150) either somewhat or strongly agreeing with the statement. Only 14.8% (n = 36) either strongly or somewhat disagreed. The issue of time-efficiency of the recruitment process was addressed by a single question examining the role of industry-sponsored credentials in making the recruitment process more time-efficient. More than half of the respondents (55.1%, n = 135) either somewhat or strongly agreed that credentials made recruitment more effective. This question had a mean of 3.5. Only 14.2% (n = 35) either somewhat or strongly disagreed. Based on the mean scores for these three questions, it appears that IT employees believe that industry-sponsored credentials aid the recruitment process by making it easier and more time-efficient. The responses to the question regarding whether credentials reduce the cost of recruitment had a mean of 3.3. Forty percent (n = 98) either somewhat or strongly agreed that credentials reduced the cost of recruitment, while slightly more than one quarter (28%, n = 44) either strongly or somewhat disagreed. Forty-two percent (n = 103) of the respondents gave this item a rating of 3 on a 5-point scale.

Four of the five items examining the perceived influence of industry-sponsored credentials on recruitment were thought (a priori) to represent a single construct. The question exploring if industry-sponsored credentials determine the needed knowledge and skills for IT jobs was not included, as this item does not reflect an individual-level related benefit of credentials. Thus, the four items considered t single construct related to the role of credentials in identifying applicant knowledge and skills, as well as the ease, cost, and time efficiency of the recruitment process. To investigate this, an exploratory factor analysis using the principal component method was conducted. The resulting eigenvalues and the percentage of variance explained suggested that the four items do represent a single construct and were, therefore, transformed into a single new variable (see Appendix D). This composite variable, labeled as "perceived benefits of industry-sponsored credentials to recruitment," was used in additional analysis presented later in this report.

Training and development. Four items on the instrument examined the perceived influence of industry-sponsored credentials on training and development. Two variables were related to training and the other two related to long-term career success. The key variables related to training were the costs of training and the time necessary for new employees to learn ...eir jobs. The means for both items were above the mid-point of 3.0. This result indicates that respondents agreed that industry-sponsored credentials reduce the costs of training and the time required for new employees to learn their jobs.

The first training-related item considered the impact on organizational training costs. The item mean was 3.18 (on a 5-point scale). A total of 107 respondents (43.6%) either agreed or strongly agreed that employees with credentials reduced training costs for the organization. Less that one third (29.8%, $n = 73$) disagreed or strongly disagreed. The second item involved the time required for newly hired IT employees o reflect a to learn their job. This item had a mean of 3.3 (on a 5-point scale). Almost half the respondents (49.8%, $n = 132$) agreed or strongly agreed that having industry-sponsored credentials would reduce the amount of time required for new employees to learn their jobs.

Two items related to career success measured the attitude towards the influence of credentials on both the initial chance of success for a newly hired IT employee, and the longer term career success of an IT employee. The means for both items were above the mid-point of 3.0. The first item examined the chance of success for a newly hired IT employee. With an item mean of 3.64, 62% ($n = 152$) of respondents indicated either agreement or a strong level of agreement with this statement. Less than 10% (9.9%) either disagreed or strongly disagreed. The second item examined the perception that industry-sponsored credentials were important to career success. Respondents were asked to specify their level of agreement to the statement that industry-sponsored IT-credentials are importan' to their career success. It should be noted that this item was contained in the introduction section to the IT employee survey. Strong agreement regarding the relationship between credentials and career success was reflected by an item mean of 3.9, with 73.4% ($n = 180$) either agreeing or strongly agreeing. Only 12.3% did not support the positively perceived relationship between industry-sponsored credentials and career success.

As in the case for the perceived influence of industry-sponsored credentials on recruitment, it was thought that the four items associating industry-sponsored credentials with training and development would form one underlying construct. Exploratory factor analysis was conducted producing a 4-item scale that explained 58% of the variance with eigenvalues in the appropriate range. The reliability (alpha) of this newly created scale is .75 (see Appendix D). This composite measure, labeled as perceived benefits of industry-sponsored credentials to training, was used in additional analysis presented later in this report.

Organizational outcomes. The following section of the instrument examined potential organizational outcomes of industry-sponsored credentials. These questions for IT employees were the same as those on the HR executive instrument. Four selected organizational outcomes were examined. The first considered the potential role of credentials to improve the ability of IT employees' theoretical understanding of IT products, networks, and customer needs. Over two thirds of IT employee respondents either disagreed or strongly disagreed that industry-sponsored credentials would lead to an increase in theoretical understanding, with an overall item mean of 2.32. Only 12.3% ($n = 30$) of the respondents agreed or strongly agreed that industry-sponsored credentials would help increase theoretical understanding.

The second organizational outcomes item considered employees' ability to creatively solve IT problems. The item mean of 3.1 suggests that employees do not strongly agree with the statement that industry-sponsored credentials play a major role in influencing their creative ability to solve IT problems.

The third item related to the potential role of credentials in promoting feelings of teamwork and camaraderie among IT employees. With the item mean of 2.87 on a 5-point scale, 25.7% (n = 63) of employee-respondents agreed that IT-industry-sponsored credentials foster feelings of teamwork and camaraderie, whereas about one third (32.7%, n = 80) either strongly or somewhat disagreed with the statement.

The final organizational outcome asked respondents their level of agreement that industry-sponsored credentials reduce the likelihood of turnover. The item mean of 2.50 indicates evenly divided responses on the issue.

Work-Related Attitudes

Five work-related attitudes were measured—perceived access to training, motivation to transfer learning, organizational commitment, job satisfaction, and turnover intentions (see Table 11 for means, standard deviations, and reliability results of the "work-related attitudes" scales).

Table 11

Means, Standard Deviations, and Reliability Results of Work-Related Attitudes Scales

Variable	Number of items	Scale mean	*SD*	a
Access to training	3	12.82	4.49	.74
Motivation to transfer learning	4	16.87	2.55	.76
Affective organizational commitment	6	28.00	8.42	.88
Turnover intentions	3	6.97	2.90	.68
Job satisfaction	3	16.45	3.98	.86

Note. N = 245.

Perceived access to training was a 3-item scale previously developed by the author (Bartlett, 2001). Confirmatory factor analysis was performed, producing an eigenvalue of 1.97, suggesting that the 3-item scale can be used with populations other than the healthcare field, for which the scale was originally developed. Reliability analysis with data from this study produced an alpha of .74 (close to the previous .77 in the original application). The scale mean was 12.8 (SD = 4.5), with the item mean 4.3 (SD = 1.8).

Motivation to transfer learning was assessed by using a 4-item scale adapted from Noe (1986) and Seyler et al. (1998). Reliability from the current study, as measured by Cronbach's alpha, was .76. The scale mean was 16.9 (SD = 2.5), with the average item mean for the four items of 4.2 (SD = .8), suggesting that respondents showed a strong willingness to transfer the skills, knowledge, and abilities learned during training sessions to the work setting.

Organizational commitment was measured by the Affective Organizational Commitment subscale from the Affective, Continuance, and Normative Commitment Scales (ACNCS) of

Allen and Meyer (1990). Results from the 245 employees in this study produced a scale mean of 28, standard deviation of 8.4, and an internal consistency of the Affective Organizational Commitment subscale of .88, which corresponds closely to the reported median reliability of .85 from previous studies (Allen & Meyer).

Job satisfaction was measured with the 3-item Michigan Organizational Assessment Questionnaire subscale. The mean for this in the current study was 16.5, with the standard deviation of 4.0. The item mean was 5.5, with the standard deviation of 1.5. The scale reliability of .86 was higher than the .77 reported by the scale authors (Cammann, Fichman, Jenkins, & Klesh, 1979).

The intent to voluntarily leave (turnover intention) was assessed with a 3-item scale adapted from Irving, Coleman, and Cooper (1997). Results from the current study of IT employees produced a scale mean of 7.0, standard deviation of 2.9, and item mean of 2.3, with an item standard deviation of 1.3. Coefficient alpha for this scale was .68, which is slightly below the pre-published .73 reported from the original application of scale (Irving, Coleman, & Cooper).

Table 12 indicates the correlation matrix for the scaled variables related to the perceived influence of industry-sponsored credentials of recruitment and training development as well as the five work-related attitudes of motivation to transfer learning, job satisfaction, turnover intention, access to training, and affective organizational commitment. A number of significant correlations were found (flagged by asterisks). The table reveals a moderately strong correlation ($r(239) = .40$, $p < .01$) between variable AFC (affective commitment) and ACT (access to training). A strong positive correlation was found between ACF (affective commitment) and JST (job satisfaction) with $r(241) = .70$, $p < .01$.

Table 12

Bivariate Correlation Matrix for Scaled Variables on Perceived Influence of Industry-Sponsored Credentials and Work-Related Attitudes

Variable	1	2	3	4	5	6	7
PIT							
PIR	.64**						
MOT	.21**	.28**	.05				
JST	.29**	.30**	.07	.22**			
TUR	.01	-.10	.05	-.12	-.34**		
ACT	.38**	.36**	.14*	.05	.38**	-.07	
AFC	.22**	.25**	-.04	.17**	.70**	-.39**	.40**

Key: $*p < .05$, $**p < .01$; Variables: PIT = Perceived influence of industry-sponsored credentials on training; PIR = Perceived influence of industry-sponsored credentials on recruitment; MOT = Motivation to transfer learning; JST = Job satisfaction; TUR = Turnover intention; ACT = Access to training; AFC = Affective commitment.

A number of Pearson correlation coefficients were calculated to explore the bivariate relationships among the 13 variables as described above. As can be seen in Table 13, a number of significant relationships were found (indicated by asterisks). Particularly, a strong positive relationship was revealed ($r(245) = .70$, $p < .01$) between the two variables, FRC (improved time-efficiency of recruitment for IT jobs) and CRC (cost of recruitment for IT jobs). This indicates that a strong relationship exists between IT-employee perceptions that industry-sponsored credentials increase the time-efficiency of recruitment and reduce the costs of recruiting. Another strong positive correlation was found between the variable FRC (improved time-efficiency of recruitment for IT Jobs) and ERC (easier recruitment for IT jobs). Overall, the correlation matrix for these 13 variables indicates no serious presence of multicollinerity.

Table 13
Bivariate Correlation Matrix for All Variables in Study

Variable	1	2	3	4	5	6	7	8	9	10	11	12
CRE												
DKS	.47**											
IKS	.35**	.59**										
ERC	.32**	.49**	.64**									
CRC	.20**	.32**	.33**	.54**								
FRC	.31**	.49**	.46**	.66**	.70**							
LTR	.28**	.35**	.39**	.35**	.34**	.38**						
RTM	.38**	.42**	.44**	.39**	.23**	.39**	.55**					
ISC	.39**	.52**	.48**	.47**	.37**	.50**	.38**	.59**				
FTW	.39**	.49**	.40**	.39**	.36**	.43**	.45**	.39**	.49**			
RTR	.37**	.28**	.25**	.25**	.21**	.26**	.40**	.30**	.34*	.57**		
RPR	-.11	-.17**	-.15**	-.05	-.15*	-.07	-.28**	-.14*	-.19**	-.22**	-.29**	
RTH	-.37**	-.41**	-.42**	-.39**	-.25**	-.41**	-.32**	-.40**	-.50**	-.43**	-.28**	.20**

Key: $*p < .05$, $**p < .01$; Variables: CRE = Perceived Importance of IT Credentials in Career Success; DKS = Determination of Knowledge and Skills for IT Jobs; IKS = Easier identification of knowledge and skills for IT jobs; ERC = Easier recruitment for IT jobs; CRC = Cost of recruitment for IT jobs; FRC = Improved time efficiency of recruitment for IT jobs; LTR = Lowered training costs for IT workers; RTM = Reduced learning time for new IT hires; ISC = Increased chances of success; FTW = Increased fostering of teamwork and camaraderie; RTR = Reduced likelihood of turnover; RPR = Reduced problem solving ability (reversed); RTH = Reduced theoretical understanding of IT work (reversed).

Comparison of Employees With and Without IT-Industry-Sponsored Credentials

A series of independent-samples t tests was conducted to explore differences between the two IT groups—IT employees with no IT-industry-sponsored credentials and IT employees with one or more IT-industry-sponsored credentials—with respect to their perceptions on the role of industry-sponsored IT credentials on recruitment and training (see Tables 14, 15, & 16).

Table 14 shows an independent-samples t test, comparing the dichotomous groups. A significant difference between the means of the two groups ($t(241) = -2.94$, $p < .05$) was found on the perceived access to training variable. The mean of IT employees with one or more IT credentials was significantly higher (mean = 13.38, $SD = 4.41$) than that of IT employees with no credentials (mean = 11.57, $SD = 4.46$), suggesting that IT employees with credentials perceive higher access to training than their colleagues without industry-sponsored credentials.

Table 14
T Test for Training Access by Employees With and Without IT-Industry-Sponsored Credentials

	N	Scale Mean	*SD*	*t*	*df*	Sig(two-tailed)
No IT Credentials	75	11.57	4.46	-2.94	241	.004*
IT Credentials	168	13.38	4.41			

Note. * indicates $p < .05$.

Another statistically significant difference was detected in the recruitment scale variable ($t(242) = -2.05$, $p < .05$). The mean of IT employees with one or more IT credentials was significantly higher (mean = 17.88, $SD = 3.89$) than that of employees with no IT credentials (mean = 16.79, $SD = 3.69$). This result implies that IT employees with industry-sponsored credentials perceive that credentials have more positive impact on the recruitment process than employees without IT-industry-sponsored credentials (see Table 15).

Table 15
T Test for Recruitment by Employees With and Without IT-Industry-Sponsored Credentials

	N	Scale Mean	*SD*	*t*	*df*	Sig(two-tailed)
No IT Credentials	75	16.79	3.69	-2.05	242	.042*
IT Credentials	169	17.88	3.89			

Note. * indicates $p < .05$.

Similarly, a t test comparing the mean scores of perceived importance of IT credentials in career success indicated that there is a statistically significant difference between the groups ($t(243) = -5.11$, $p < .05$). The mean of IT employees with one or more IT credentials was significantly higher (mean = 4.12, $SD = 0.96$) than that of employees with no IT credentials (mean = 3.40, $SD = 1.13$). This finding implies that employees with IT credentials view credentials as having more of an impact on career success, as compared to employees without IT credentials (see Table 16).

Table 16
T Test for Importance of Credentials in Career Success by Employees With and Without IT-Industry-Sponsored Credentials

	N	Mean	*SD*	*t*	*df*	Sig(two-tailed)
No IT Credentials	75	3.40	1.13	-5.11	243	.000*
IT Credentials	170	4.12	0.96			

Note. * indicates $p < .05$.

The Relationship of Work-Related Attitudes and Number of IT-Industry-Sponsored Credentials to Organizational Commitment

The importance of retaining qualified and skilled employees in the IT industry is seen as a desired outcome of effective recruitment efforts. To explore this issue, organizational commitment was used as the dependent variable in a regression analysis. Organizational commitment was regressed on three independent variables thought to influence the strength of attachment felt by IT employees to their employing organization. The three independent variables considered were job satisfaction, perceived access to training, and the number of IT certifications. The analysis indicates that these two variables—job satisfaction and access to training—positively affect organizational commitment, while the number of IT certifications is negatively related to the dependent variable. In other words, the level of organizational commitment is higher for IT employees who report higher levels of job satisfaction and access to training, and fewer IT-industry-sponsored credentials.

In the overall model, the R^2, .52, (see Table 17) indicates that 52 % of the variation in organizational commitment is explained by the variation in all three independent variables. The overall model is statistically significant with an F ratio of 84.61.

Table 17
The Relationship of Work-Related Attitudes and Number of IT-Industry-Sponsored Credentials to Organizational Commitment

Model	*R*	R^2	Adjusted R^2	Std. Error of the Estimate	*F* Ratio	Sig, *F* Change
1	.701[a]	.491	.489	6.0535	226.8	.000**
2	.715[b]	.511	.507	5.9468	122.3	.002**
3	.722[c]	.521	.515	5.8959	84.6	.025*

Note. [a] Predictors: job satisfaction; [b] Predictors: job satisfaction and access to training; [c] Predictors: job satisfaction, access to training, and the number of IT certifications.
** indicates $p < .01$. * $p < .05$.

This section of the report presented the research findings from the HR executive and IT employee surveys. The following section presents a summary and discussion of the results.

SUMMARY

This study was designed to examine the perceptions of both human resource managers and IT employees about the influence of IT-industry-sponsored credentials on recruitment, training and career development, and a series of organizational outcomes. The following is a summary of the major findings of this study:

- On average, the organizations included in the study hired 50 new IT employees in the past year, spent almost 2 months to hire a new IT employee, and currently have 5 IT-related vacancies.
- Eighty-five percent of HR executives noted an increasing number of job applicants with IT-industry-sponsored credentials.
- HR executives estimated that almost half of their IT employees have at least one industry-sponsored IT credential.
- HR executives ranked a traditional 4-year college degree in an IT-related field higher than an IT-industry-sponsored credential as the desired credential when considering hiring new employees.
- Close to 80% of HR executives view the primary benefit of IT-industry-sponsored credentials as a means to increase the ease of identifying the level of applicants' knowledge, skills, and abilities. Other benefits of IT-industry-sponsored credentials are that they contribute to making the entire recruitment process easier and more time efficient.
- The majority of HR executives view IT employees with college degrees as being more likely to receive multiple job offers, be hired, and be compensated at higher levels than those without college degrees. They also believe that IT employees with college degrees, compared to those without college degrees, are more productive, committed to the organization, involved in on-going learning, and likely to transfer skills learned in training to their job.
- Two thirds of responding HR executives agreed that their organizations provide funding for IT-certification programs facilitated by outside vendors. Almost half of the executives stated that their organizations require IT employees to maintain their IT-related certification.
- More than two thirds of the 245 IT-employee respondents have one or more industry-sponsored credential.
- In general, the majority of IT employees believe industry-sponsored credentials influence the cost, ease, and efficiency of the recruitment process.

- The majority of the IT employees believe that credentials reduce the cost of training for their organization, reduce the time for new employees to learn their jobs, and increase the chance of success for a new-hire.

- Only 12.3 % of IT employees agree that industry-sponsored IT credentials improve their theoretical understanding of key issues related to the IT industry.

- Slightly more than half of the IT employees believe that IT-industry-sponsored credentials increase the likelihood of turnover.

- IT employees with IT-industry-sponsored credentials perceive access to training more positively than those without credentials.

- IT employees with IT-industry-sponsored credentials perceive the impact of credentials on the recruitment process more positively than employees without credentials.

- IT employees with IT-industry-sponsored credentials view credentials as having a more positive influence on their career success than those IT employees without industry-sponsored certifications.

- While job satisfaction and access to training play a positive role in the level of organizational commitment among IT employees, the number of IT-industry-sponsored credentials has a negative impact on the level of organizational commitment.

DISCUSSION

This report provides data from a study exploring the perceptions of both human resource managers and IT employees about the influence of IT-industry-sponsored credentials. More specifically, this study examined the influences of industry-sponsored credentials on recruitment and training, along with selected organizational outcome measures. The data were collected from a sample of large U.S. organizations with 500 or more employees. Senior-level human resource executives completed a paper-and-pencil questionnaire, while IT employees completed an Internet-based survey. Responses were received from 33 HR managers and 245 IT employees representing 13 organizations. The following section of this report discusses the findings of this study; new knowledge we now have about industry-sponsored credentials; and implications for CTE policymakers, educators, and researchers. Suggestions and proposed directions for further research on industry-sponsored credentials are also discussed.

HR Executive Findings

The perceptions of HR executives toward IT-industry-sponsored credentials are important because the attitude of the senior-ranking HR executive no doubt influences the policies and management practices of the entire organization. There is also a possibility that the influence of these senior-level executives extends far beyond their own organizations. Existing research suggests that HR policies, practices, and procedures, as well as the attitudes of senior HR executives in the largest, most visible organizations, may influence the adoption of HR management practices in smaller organizations.

The findings from this study show that the overwhelming majority of respondents have detected an increased number of job applicants who hold IT-industry-sponsored credentials. This supports previous studies and IT-industry reports that have documented the increased numbers of people earning IT-industry-sponsored credentials to gain entry to or advancement in IT-related occupations.

Findings from the HR executive component of this study indicate that traditional 4-year college degrees remain the desired qualification for entry into the IT industry. Yet, HR executives who responded to the study hold attitudes that IT-industry-sponsored credentials assist in the recruitment process, reduce training costs, and have a somewhat positive impact on training, learning, motivation to transfer learning, and job performance. In contrast, the majority of responding HR executives also believed that industry-sponsored credentials reduce employees' sense of teamwork, camaraderie, and ability to creatively solve problems. These results are potentially of concern for employees and CTE educators—especially those planning to use industry-sponsored credentials as an entry-point into the IT industry—given the continued move toward team-based work structures and demand for higher-level problem-solving skills.

Based on the current findings, it would be interesting to note the sources of information from which HR executives acquire information about IT-related credentials. Given the shortage of research on IT-industry-sponsored credentials, it is possible that HR executive attitudes are being

shaped by the portrayal of IT certification in the media and in various trade and professional association publications. Additional research in this area is needed.

The review of existing literature suggested that industry-sponsored credentials are viewed as playing an important role in defining the knowledge base and skill level for an industry. Therefore, credentials become a useful tool for human resource managers involved in recruiting because applicants with a recognized credential can be assumed to possess the knowledge, skills, and abilities that relate to the credential they hold. Recruitment researchers urge that applicant credentials should be one of many factors, but not the only factor, to consider when making hiring decisions.

Perhaps the slowdown of the U.S. economy and reduced job-growth projections for the IT industry will result in a shift toward more theoretically sound human resource management practices for IT employees. The myth of the IT-industry-sponsored credential as the meal ticket to prosperity emerged in the halcyon days of almost non-existent unemployment, numerous dot.com start-ups, $25,000 signing bonuses, and rags-to-riches stories for high-school students with computer skills. In their scramble for human capital, many organizations sought to save time and effort in recruiting by relying on industry-sponsored credentials as the sole measure of an applicant's IT-related knowledge, skills, and abilities. In addition, the detailed analysis needed to determine on-going training and development needs of employees was found to be competing with the need to continually update industry-sponsored credentials. Now that the IT industry is showing signs of reduced growth (but still positive growth), HR managers are likely to invest more time and effort in requiring and reviewing a broad range of applicant qualifications and experiences. Such efforts will be required so organizations can capitalize on the theory of person-organization fit (Kristof, 1996).

Organizations strive for "the elusive criterion of fit in human resource staffing decisions" (Judge & Ferris, 1993, p. 47). All organizations seek employees who fit with the company's values and culture, who are committed to the organization, and who are productive in working to achieve stated missions and goals. In turn, individuals seek jobs that fit with their needs. The theory of person-organization fit is used to describe the match between an individual employee and his or her workplace environment. Vocational psychologists (e.g., Furnham, 2001; Lievens, Decaesteker, Coetsier, & Geirnaert, 2001; Schneider, 2001) are showing increased interest in person-organization fit, as it is related to existing theories of vocational preference (such as Holland's (1959) theory of vocational choice). It is hoped that the results of this study will encourage further exploration of how organizational behavior, industrial and vocational psychology, human resource management, and human resource development theories relate to recruitment. Such efforts are likely to inform the study and practice of career and technical education.

Judge and Ferris (1993) noted that the traditional view of human resource management recruitment assumed a rational framework, where the objective qualifications, credentials, and certifications of individuals are matched to the requirements of the job. They suggest that this approach does not reflect the political reality in today's complex organizations. The findings of the HR-executive component of this research would appear in some ways to support this

perspective. The decision to hire an IT employee, either a newly hired external employee or an internal promotion, is dependent on a complex array of criteria that seek to match the knowledge, skills, and abilities of applicants to the vacancies existing within the organization. The formal documentation of applicants' skills, knowledge, and abilities represented in the qualifications and credentials they hold is likely to be only one of many decision criteria. This study suggests that senior-ranking HR executives possess attitudes toward IT-industry-sponsored credentials that may influence how they view employees applying for jobs. Furthermore, these attitudes may also influence the extent to which HR executives support the on-going employee training and development required to maintain and update industry-sponsored credentials. Additional research that explores the perception of IT-industry-sponsored credentials among different managerial levels is needed. Such research should consider managerial perception in terms of the utility of industry-sponsored credentials to the employee and the organization.

IT Employee Findings

It is a reflection of the growth and acceptance of IT-industry-sponsored credentials that almost 70% of the 245 respondents in this study have at least one IT-sponsored credential. The findings of this research indicate support for the proposition that IT employees feel that industry-sponsored credentials will influence the recruitment process and opportunities for further training and development. Future work is needed to explore the relationship of industry-sponsored credentials to workplace attitudes, despite the weak correlations found in this study between employees with and without IT-industry-sponsored credentials, and between the number of industry-sponsored credentials and desired work-place attitudes. The attitudes explored in this study—motivation to transfer learning, organizational commitment, and job satisfaction—are highly desired in today's knowledge economy. Efforts to raise awareness of why these attitudes are valued by employers could be built into IT education and training programs.

In the early days of IT-industry-sponsored credentials, the vast majority of people who earned certifications were professional IT employees already well-established in the industry. The trend in more recent times is of an increasing number of people earning credentials with little or no prior experience in the IT industry—people who have expectations of finding immediate employment and a high salary, who potentially damage the reputation and benefits of industry-sponsored credentials. The IT training industry is now being urged not to over-hype certifications and industry-sponsored credentials (ExamCram, 2001b).

The results of this research show that IT employees believe industry-sponsored credentials do influence recruitment and training. More specifically, the finding that employees perceive credentials reduce the cost of organizational recruiting, while also increasing the ease and efficiency of recruitment, may reflect one of the prime motivating factors for enrollment in industry-sponsored credentials programs. The IT employees surveyed in this study also perceived that credentials would influence the training and development function in organizations. The results indicated that employees perceive credentials as reducing the cost of training, reducing the time for a new hire to learn the job, and increasing the chance of success for a new employee. As training and development becomes increasingly important within the concept of lifelong learning, a greater number of employees might view industry-sponsored

credentials as an opportunity to save their employer the costs and time associated with training provided to new-hires, while also increasing their chance of success in a new job.

The relationship between the type of qualification held by employees and turnover is worthy of further investigation. More than half of the employees responding to this survey expressed agreement that IT-industry-sponsored credentials will increase the likelihood of turnover. Voluntary turnover is an issue of critical concern to many organizations dependent on IT employees, yet the reasons for turnover among IT workers are not well-understood. That employees believe credentials increase the likelihood of turnover may reflect the increased marketability of employees with desired credentials.

The finding that employees with industry-sponsored credentials perceive credentials as having a greater influence on recruitment and training, as compared to employees without credentials, is perhaps to be expected. This might reflect cognitive dissonance, as employees with credentials justify the effort, time, and cost required to earn and maintain their credentials. Further research in this area could be interesting because an attributional effect may be present, in which employees with credentials attribute their recruitment and career success solely to their industry-sponsored credentials at the expense of other potential explanations.

It is thought that this is the first study to examine the influence of industry-sponsored credentials on the affective form of organizational commitment. The finding of a negative relationship between the number of credentials held and the affective form of organizational commitment suggests that the level of attachment between employees and their employing organization may decline with an increase in the number of credentials held. The regression analysis examining the relationship between work-related attitudes and organizational commitment found a significant relationship between job satisfaction, access to training, and the number of credentials. This analysis, which considered not only the influence of job attitudes but also the number of industry-sponsored credentials on organizational commitment, adds to the growing body of knowledge on this much-desired workplace attitude of employee loyalty. These findings have implications for career and technical educators because existing research has determined that higher levels of organizational commitment are related to lower levels of turnover, and to higher levels of motivation for future training—significant issues in the IT industry and in many other industries.

The credentialing issue has created considerable interest in both secondary and postsecondary education institutions because of their potential role in delivery. Certification and credentialing are noted as being a hot topic for continuing education and training, with Carnevale and Desrochers (2001) describing the challenges and opportunities certifications present to community colleges. Yet, the value of industry-sponsored credentials remains largely unproven, raising many questions as to their role and place. This study provides an initial look at how both employers and employees view credentials. Much additional research is needed to look at other outcomes of industry-sponsored credentials to both individual employees and the organizations in which they are employed. In addition to further investigations into work-place attitudes, variables to be considered in future research should include job performance, salary, and career advancement

It is in the long-term interest of the IT industry, students, and employees, as well as the CTE profession, to have a workforce of IT professionals that is well-prepared to work within the IT industry and to learn new jobs within future configurations of this dynamic career cluster. Certification should play a role at the postsecondary and continuing education levels—a time when individuals are preparing to obtain or change jobs. Research is yet to examine the different providers of industry-sponsored credentials. For example, are career entry and advancement influenced by differences in the type of credential provider. In other words, are students who complete a well-grounded curriculum that integrates preparation for earning an IT-industry-sponsored credential better served than students who take an intensive and focused training program that focuses solely on test preparation for credentials? The answers to such questions would benefit CTE providers—especially community colleges.

A potential extension of this study would be to explore individual motivations and attitudes that influence enrollment in an industry-sponsored credential program. A longitudinal research design would facilitate the much-needed follow-up required to investigate the outcomes that result from participation in industry-sponsored credential education and training programs. This study has focused on industry-sponsored credentials from one industry, yet it must be acknowledged that credentialing and certification are now major issues in the education and training for many occupations and professions. Future research is needed to explore industry-sponsored credentials in other industries as well.

REFERENCES

Acemogle, D., & Pischke, J. (1999). *Certification of training and training outcomes.* Boston: Massachusetts Institute of Technology, Department of Economics.

Adelman, C. (2000). *A parallel postsecondary universe: The certification system in information technology.* Washington, DC: U.S. Department of Education.

Agarwal, R., & Ferratt, T. W. (1998). Recruiting, retaining, and developing IT professionals: An empirically derived taxonomy of human resource practices. *Proceedings of* the 1998 Conference on Computer Personnel Research (*pp.* 292–302). Boston: ACM.

Allen, N. J., & Meyer, J. P. (1990). The measurement and antecedents of affective, continuance, and normative commitment to the organization. *Journal of Occupational Psychology, 63,* 1–18.

Allen, N. J., & Meyer, J. P. (2000). Construct validation in organizational behavior research: The case of organizational commitment. In R.D. Goffin & E. Helmes (Eds.), *Problems and solutions in human assessment* (pp. 285–314). Boston: Kluwer.

Argetsinger, A. (2001, June 10). Certificate is continuing education goal. *Star Tribune,* p. E7.

Armstrong, C. P., & Sambamurthy, V. (1999). Information technology assimilation in firms: The influence of senior leadership and IT infrastructures. *Information Systems Research, 10*(4), 304–327.

Babbie, E. R. (1990). *Survey research methods.* Belmont, CA: Wadworth.

Bamberger, P., & Meshoulam, I. (2000). *Human resources strategy: Formulation, implementation, and impact.* Thousand Oaks, CA: Sage.

Barber, A. E. (1998). *Recruiting employees.* Thousand Oaks, CA: Sage.

Barber, A. E., Wesson, M. J., Roberson, Q. M., & Taylor, M. S. (1999). A tale of two job markets: Organizational size and its effects on hiring practices and job search behavior. *Personnel Psychology, 52,* 841–867.

Barley, S. R. (1999, March). Competence without credentials: The promise and potential problems of computer-based distance education. In N.G. Stacey (Ed.), *Competence without credentials.* Retrieved September 26, 2001, from http://www.ed.gov/pubs/Competence/section2.html

Barr, A., & Tessler, S. (1998). *How will the software talent shortage end?* Retrieved October 3, 2001, from http://www.stanford.edu/group/scip/avsgt/how1197.pdf

Bartlett, K. R. (2001). The relationship between training and organizational commitment: A study in the health care field. *Human Resource Development Quarterly, 12*(4), 335–352.

Bassi, L. J. (1999, March). Are employers' recruitment strategies changing: Competence over credentials? In N.G. Stacey (Ed.), *Competence without credentials.* Retrieved September 26, 2001, from http://www.ed.gov/pubs/Competence/section3.html

Bird, D. (2001). Multiple certification options [Electronic version]. *Certification Magazine.* Retrieved October 12, 2001, from http://www.certmag.com/issues/apr01/feature_bird.cfm

Blair, D. V., O'Neal, H. F., & Price, D. J. (1999). Effects of expertise on state self-efficacy and state worry during a computer-based certification. *Computers in Human Behavior, 15,* 511–530.

Breaugh, J. A. (1992). *Recruitment: Science and practice.* Boston: PWS.

Breaugh, J. A., & Starke, M. (2000). Research on employee recruitment: So many studies, so many remaining questions. *Journal of Management, 26*(3), 405–434.

Cammann, C., Fichman, M., Jenkins, D., & Klesh, J. (1979). *The Michigan Organizational Assessment Questionnaire.* Unpublished manuscript, Ann Arbor, MI: University of Michigan.

Cantara, M., & Palma, M. (2001, February). *Move over chicken little: 10 reasons why the sky is not falling on the IT professional services market.* (Note No. PFST-NA-DP-0102). Stamford, CA: Gartner.

Capelli, P. (1999). Career jobs are dead. *California Management Review, 42*(1), 146–167.

Carnevale, A. P., & Desrochers, D. M. (2001). *Help wanted...credentials required: Community college in the knowledge economy.* Princeton, NJ: Educational Testing Service.

Caron, R. (1998, September 14). Be a choice employer. *Information Week, 700,* 299.

Cervero, R. M. (2001). Continuing professional education in transition, 1981–2000. *International Journal of Lifelong Education, 20*(1/2), 16–30.

Chalofsky, N. (1992). A unifying definition for the human resource development profession. *Human Resource Development Quarterly, 3*(2), 175–182.

Cohen, Y., & Pfeffer, J. (1986). Organizational hiring standards. *Administrative Science Quarterly, 31,* 1–24.

The Computing Technology Industry Association. (2001). *CompTIA workforce study: The crisis in IT service & support.* Retrieved October 15, 2001, from http://www.comptia.org/workforce/ComptiaWorkforceStudy.pdf

Connolly, P. J., & Yager, T. (2000). Do certificates matter? *InfoWorld.* Retrieved August 13, 2001, from http://www.infoworld.com/articles/tc/xml/00/12/25/001225tcpcp.xml

Couper, M. P. (2000). Web surveys: A review of issues and approaches. *Public Opinion Quarterly, 64,* 464–494.

Crampton, S. M., & Wagner, J. A. (1994). Percept-percept inflation in microorganizational research: An investigation of prevalence and effect. *Journal of Applied Psychology, 79,* 67–76.

DataMaster Business Solutions. (2000). *2000 Computer industry salary survey.* Retrieved July 20, 2001, from http://www.datamasters.com/survey00.html

ExamCram. (2001a). *Certification planner.* Retrieved April 30, 2001, from http://www.examcram.com/studyresource/planner/planning.asp

ExamCram. (2001b). *Open forum.* Retrieved April 30, 2001, from http://www.examcram.com/studyresource/openforum/

Fabris, P. (1998). Desperate times, creative measures [Electronic version]. *CIO Magazine.* Retrieved August 20, 2001, from http://www.cio.com/archive/010198_over.html#

Freeman, P. & Aspray, W. (1999). *The Supply of Information Technology Workers in the United States.* Study supported by Computing Research Association. Retrieved August 31, 2001, from http://www.cra.org/reports/wits/it_worker_shortage_book.pdf

Furnham, A. (2001). Vocational preference and P-O fit: Reflections on Holland's theory of vocational choice. *Applied Psychology: An international review, 50*(1), 5–29.

Gabelhouse, G. (2000). CertMag's salary survey [Electronic version]. Retrieved October 10, 2001, from http://www.certmag.com/issues/dec00/feature_gabelhouse.cfm

Gillin, P. (1994). Tame the restless computer professional. *HR Magazine, 39*(11), 140–142.

Goth, G., & Blank, C. (1999, March–April). Scarcity of IT workers is the mother of recruiter innovations. *IT Pro,* 15–17.

Greenberg, R. (2000). Filling the gap. *Techniques, 75*(7), 26–27.

Greening, D. W., & Turban, D. B. (2000). Corporate social performance as a competitive advantage in attracting a quality workforce. *Business and Society, 39*(3), 254–280.

Greenspan, A. (1998). *The implications of technological changes.* Speech delivered at the Charlotte Chamber of Commerce, Charlotte, NC. Retrieved August 23, 2001, from http://www.federalreserve.gov/boarddocs/speeches/1998/19980710.htm

Hale, J. (2000). *Performance-based certification: How to design a valid, defensible, cost-effective program.* San Francisco: Jossey-Bass.

Harris, M. M., & Fink, L. S. (1987). A field study of applicant reactions to employment opportunity. *Personnel Psychology, 40*(4), 765–784.

Headd, B. (2000, April). The characteristics of small-business employees. *Monthly Labor Review, 123*(4), 13–18.

Higgins, L. V. H. (1998). The role of inducements in the recruitment program of U.S. computer companies. *Proceedings of* the 1998 Conference on Computer Personnel Research *(pp.* 123–132), Boston: ACM.

Hilton, M. (2001). Information technology workers in the new economy. *Monthly Labor Review, 124*(6), 41–45.

Holland, J. (1959). A theory of vocational choice. *Journal of Counseling Psychology, 6*, 34–45.

Holt, M. E. (1991). A rationale for certificate programs. In M. E. Holt & G. J. Lopos (Eds.), *Perspective on educational certificate programs.* San Francisco: Jossey-Bass.

Holton, E. F., Bates, R. A., Seyler, D. L., & Carvalho, M. B. (1997). Toward construct validation of a transfer climate instrument. *Human Resource Development Quarterly, 8*(2), 95–113.

IBM. (1999). *ROI study.* Retrieved October 1, 2001, from http://www-1.ibm.com/certify/program/roistudy.shtml

IDC. (1999). *Benefits & productivity gains realized through IT certification.* Retrieved August 23, 2001, from http://www.ecertifications.com/idcrep_itcert.html

Information Technology Association of America (2001a). *The U.S. information technology industry: A brief overview.* Retrieved August 31, 2001, from http://www.itaa.org/news/itinddesc.pdf

Information Technology Association of America. (2001b, April). *When can you start? Building better information technology skills and careers.* Retrieved August 22, 2001, from http://www.itaa.org/workforce/studies/01execsumm.htm

Information Technology Association of America. (2000, April). *Bridging the gap: Information technology skills for a new millennium.* Retrieved August 22, 2001, from http://www.itaa.org/news/pubs/product.cfm?EventID=50

Irving, P. G., Coleman, D. F., & Cooper, C. L. (1997). Further assessments of a three-component model of occupational commitment: Generalizability and differences across occupations. *Journal of Applied Psychology, 82*(3), 444–452.

Judge, T. A., & Ferris, G. R. (1993). The elusive criterion of fit in human resources staffing decisions. *Human Resource Planning, 15*(4), 47–67.

Kaye, B. K., & Johnson, T. J. (1999). Research methodology: Taming the cyber frontier. *Social Science Computer Review, 17*(3), 323–337.

Kerckhoff, A. C., & Bell, L. (1998). Hidden capital: Vocational credentials and attainment in the United States. *Sociology of Education, 71,* 152–174.

Kristof, A. L. (1996). Person-organization fit: An integrative review of its conceptualizations, measurement, and implications. *Personnel Psychology, 49,* 1–49.

Kuncicky, D., & Wynn, B. A. (1998). *Education and training systems administrator: A survey.* Berkeley, CA: The USENIX Association.

Lemen, A. E. (2001, January–February). Certification check. *ITrecruitingmag.com* Retrieved August 30, 2001 from http://www.itrecruitermag.com/magazine/ display_techtraining.asp?Content ID=372

Lievens, F., Decaesteker, C., Coetsier, P., & Geirnaert, J. (2001). Organizational attractiveness for prospective applicants: A person-organization fit perspective. *Applied Psychology: An International Review, 50*(1), 30–51.

Macan, T. H., & Dipboye, R. L. (1990). The relationship of interviewers' preinterview impressions to selection and recruitment outcomes. *Personnel Psychology, 43*(4), 475–768.

Mathis, R., & Jackson, J. H. (1997). *Human resource management.* St. Paul, MN: West.

McMenamin, B. (1998, December). The tyranny of the diploma. *Forbes, 14,* 104–109.

MCSE (2000). *MCSE windows 2000 certification headstart.* Berkeley, CA: Osborne McGraw-Hill.

Meares, C. A., Sargent, J. F., Jr. (1999). U.S. Department of Commerce, Office of Technology Policy. *The digital workforce: Building infotech skills at the speed of innovation.* Retrieved August 20, 2001, from http://www.ta.doc/gov/Reports/ TechPolicy/digital.pdf

Meyer, J. P. & Allen, N. J. (1997). *Commitment in the workplace: Theory, research, and application.* Thousand Oaks, CA: Sage.

Miller, L., Kellie, D., & Acutt, B. (2001). Factors influencing the choice of initial qualifications and continuing development in Australia and Britain. *International Journal of Training and Development, 5*(3), 196–222.

Mishel, L., Bernstein, J., & Schmitt, J. (2001). *The state of working America 2000–2001.* Economic Policy Institute, Ithaca, NY: Cornell University Press.

Murray, J. P. (2000). Improving the IT hiring rate. *Information Systems Management, 17*(3), 33–35.

Noe, R. A. (1999). *Employee training and development.* Boston: Irwin McGraw-Hill.

Noe, R. A. (1986). Training attributes and attitudes: Neglected influences of training effectiveness. *Academy of Management Review, 11,* 736–749.

National Research Council. (2001). Committee on workforce needs in information technology. *Building a workforce for the information economy.* Washington, DC: National Academy Press.

O'Neil, H. (1997). *Workforce readiness: Competencies and assessment.* Mahwah, NJ: Lawrence Erlbaum.

Paquet, C. (1999). *Report counts 147 million global net users.* Retrieved August 27, 2001, from http://www5.cnn.com/TECH/computing/9902/12/globalnet.idg

Pare, G., & Tremblay, M. (2000). *The measurement and antecedents of turnover intentions among IT professionals.* Montreal, Ontario, Canada: CIRANO.

Penkoff, D. W., Colman, R. W., & Katzman, S. L. (1996). *From paper-and-pencil to screen-and-keyboard: Toward a methodology for survey research on the Internet.* Paper presented at the annual conference of the International Communication Association, Chicago.

Pennings, J. M. (1988). Information technology in production organizations. International *Studies of Management & Organizations, 17*(4), 68–89.

Powell, P. L. (1999). Evaluation of information technology investments: Business as usual? In L. P. Willcocks & S. Lester (Eds.), *Beyond the IT productivity paradox,* (pp. 151–182). Chichester, NY: Wiley.

Ray, C. M., & McCoy, R. (2000). Why certification in information systems? *Information Technology, Learning, and Performance Journal, 18*(1), 1–4.

ReferenceUSA. (2001). Omaha, NE : InfoUSA.

Robinson, P., & Manacorda, M. (1997). *Qualifications and the labour market in Britain: 1984–94 skill based change in the demand for labour or credentialism.* London: Center for Economic Performance.

Rousseau, D. M. (1989). Psychological and implied contracts in organizations. *Employee Right and Responsibilities Journal, 2,* 121–139.

Rynes, S. L. (1991). Recruitment, job choice, and post-hire consequences: A call for new research directions. In M. D. Dunnette & L. M. Hough (Eds.), *Handbook of industrial and organizational psychology* (2nd ed., pp. 399–444). Palo Alto, CA: Consulting Psychologists Press.

Rynes, S. L., & Barber, A. E. (1990). Applicant attraction strategies: An organizational perspective. *Academy of Management Review, 15*(2), 286-310.

Sadler-Smith, E., Sargeant, A., & Dawson, A. (1998). Higher level skills training and SMEs. *International Small Business Journal, 16*(2), 84–94.

Schmidt, G. R. (2001). *Top ten IT industry profiles summary review for the Minnesota High Tech Association.* Eagan, MN: Minnesota High Tech Association.

Schneider, B. (2001). Fits about fit. *Applied Psychology, 50*(1), 141–152.

Schneider, B., Ashworth, S. D., Higgs, A. C., & Carr, L. (1996). Design, validity, and use of strategically focused employee attitude surveys. *Personnel Psychology, 49,* 695–705.

Secretary's Commission on Achieving Necessary Skills. (1991). *What work requires of schools.* Washington, DC: U.S. Department of Labor.

Segalla, M., Sauquet, A., & Turati, C. (2001). Symbolic vs. functional recruitment: Cultural influences on employee recruitment policy. *European Management Journal, 19*(1), 32–43.

Seyler, D. L., Holton, E. F., Bates, R., Burnett, M. F., & Carvolho, M. A. (1998). Factors affecting motivation to transfer training. *International Journal of Training and Development, 2*(1), 2–16.

Snider, J. C., Marasco, F., & Keene, D. (1991). Institutional policies and procedures: Bridges or barriers? In M. E. Holt & G. J. Lopos (Eds.), *Perspective on educational certificate programs* (pp. 43–54). San Francisco: Jossey-Bass.

Spaeth, J. L., & O'Rouke, D. P. (1994). Designing and implementing the national organizations study. *American Behavioral Scientist, 37*(7), 872–890.

Spector, P. E. (1997). *Job satisfaction.* Thousand Oaks, CA: Sage.

Spence, M. (1972). Job market signaling. *Quarterly Journal of Economics, 87*(3), 355–374.

Sproull, L. S. (1986). Using electronic mail for data collection in organizational research. *Academy of Management Journal, 29*(1), 159–169.

Stam, M., & Molleman, E. (1999). Matching the demand for and supply of IT professionals: Towards a learning organization. *International Journal of Manpower, 20*(6), 375–387.

Taylor, M. S., & Bergmann, T. J. (1987). Organizational recruitment activities and applicants' reactions at different stages of the recruitment process. *Personnel Psychology, 40,* 261–285.

Taylor, M. S., & Giannantonio, C. M. (1993). Forming, adapting, and terminating the employment relationship: A review of the literature from individual, organizational, and interactionist perspectives. *Journal of Management, 19,* 461–515.

Terranova, T. (2000). Producing culture for the digital economy. *Social Text 2000, 18, 2*(63), 33–58.

Tharenou, P., & Conroy, D. K. (1994). Men and women managers' advancement. *Applied Psychology: An International Review, 43,* 5–31.

Tittel, E. (2000). The certification aftermarket [Electronic version]. *Certification Magazine.* Retrieved August 10, 2001, from http://www.certmag.com/issues/nov00/feature_tittel2.cfm

Turner, R. J. (1960). Sponsored and contest mobility and the school system. *American Sociological Review, 25,* 855–867.

U.S. Bureau of Labor Statistics. (2000, February). *Occupational Outlook Handbook, 2000–01.* Retrieved August 20, 2001, from http://www.stats.bls.gov/oco/home.htm

U.S. Department of Commerce, Office of Technology Policy. (1997). *America's new deficit: The shortage of information technology workers.* Retrieved August 20, 2001, from http://www.ta.doc.gov/reports/itsw/itsw.pdf

van Ours, J., & Ridder, G. (1992). Vacancies and the recruitment of new employees. *Journal of Labor Economics, 19*(2), 138–155.

Watts, J. R. (2001). The H-1 visa: Free market solutions for business and labor. *Population Research and Policy Review, 20*(2), 143–156.

Weible, R., & Wallace, J. (1998, Fall). Cyber research: The impact of the Internet on data collection. *Marketing Research, 10*(3), 19–24.

Weiss, A. (1995). Human capital vs. signaling explanations of wages. *Journal of Economic Perspectives, 9*(4), 133–154.

Wonacott, M. E. (2000). Credentials: One size fits all? *The Highlight Zone Research at Work, 2.* National Dissemination Center for Career and Technical Education. Columbus, OH: The Ohio State University.

Wong, C., Marshall, J. N., Alderman, N., & Thwaites, A. (1997). Management training in small and medium-sized enterprises: Methodological and conceptual issues. *The International Journal of Human Resource Management, 8*(1), 45–65.

Wright, P. C. (1997). Certification: A policy alternative for developing both traditional and emerging trades and occupations. *International Journal of Manpower, 18*(3), 248–262.

APPENDIX A

CTE NATIONAL RESEARCH CENTER
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CAREER & TECHNICAL EDUCATION

Hiring Volume and Frequency

1. How many IT employees are currently employed in your firm? _____ IT employees
2. How many IT related vacancies (unfilled positions) does your firm currently have? _____ IT vacancies
3. How many IT employees has your firm hired over the past 12 months? _____ IT employees
4. On average how long does it take your firm to hire IT employees? _____ week(s)
5. What types of IT jobs are typically posted in your organization? (Check all that apply)

- ☐ Data/Database Administrator
- ☐ Network Administrator
- ☐ Programmer Analyst
- ☐ Software Engineer
- ☐ Technical Communications
- ☐ Technical Sales
- ☐ Technical Support/Help Desk
- ☐ Telecommunications Specialist
- ☐ Quality Assurance Engineer
- ☐ Webmaster
- ☐ Others (please specify)
  _____
  _____
  _____

IT Industry Credentials

6. Now think about the credentials of IT employees in your organization. Indicate your best estimate of the percentage of employees who have the following credentials by putting an "X" on the percentage bar

EXAMPLE: Percentage of IT employees with 4-year undergraduate degree.
You estimate 75% and put an "X" on the approximate spot.

0% ←——|——X——→ 100%

Less than high school	0%	100%
High school diploma	0%	100%
2-year vocational/technical college or community college degree	0%	100%
4-year undergraduate degree in computer science, math or technology	0%	100%
4-year undergraduate degree—not related to IT	0%	100%
Master's degree or above in computer science, math or technology	0%	100%
Master's degree or above—not related to IT	0%	100%
IT industry-sponsored credentials or certificates	0%	100%

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7. How important are the following credentials/certifications in your decision to hire a new non-managerial level IT employee?

	Not At All Important				Very Important
High school diploma	1	2	3	4	5
2-year vocational/technical college or community college degree	1	2	3	4	5
4-year undergraduate degree in computer science, math or technology	1	2	3	4	5
4-year undergraduate degree–not related to IT	1	2	3	4	5
Master's degree or above in computer science, math or technology	1	2	3	4	5
Master's degree or above not related to IT	1	2	3	4	5
IT industry sponsored credentials or certificates	1	2	3	4	5

8. In your opinion, do people responding to your firm's job advertisements increasingly have IT industry-sponsored credentials—such as Microsoft Certified Systems Engineer, Certified Novell Administrator, A+ Certified, and Sun Certified Programmer for the Java Platform?
   ❑ Yes ❑ No

9. Based on your organization's ability to hire IT workers, do you believe that the predicted shortage of IT workers appears to be correct?
   ❑ Yes ❑ No

10. What percentage of IT applicants responding to your firm's job advertisements typically have the desired credentials? _____%

11. Among all applicants for non-managerial IT positions in your organization, what percentage of applicants have industry sponsored credentials as part of their qualifications? _____%

12. Do you specify IT certificates or credentials for certain IT positions?
   ❑ Yes ❑ No

13. Do you have any IT jobs where the only requirement is that applicants have a relevant IT industry-sponsored credential?
   ❑ Yes ❑ No

14. In this section, consider the degree to which you agree or disagree with the following statements:

When comparing IT employees with and without a college degree, I believe those with a college degree are...	Strongly Disagree				Strongly Agree
More likely to receive multiple job offers	1	2	3	4	5
More likely to be hired	1	2	3	4	5
Less likely to be paid more	1	2	3	4	5
Less productive	1	2	3	4	5
More motivated to learn	1	2	3	4	5
Less likely to transfer what they learn back to their job	1	2	3	4	5
More likely to participate in in-house training and development	1	2	3	4	5
More likely to participate in externally provided training and development	1	2	3	4	5
More likely to aspire to management/administration positions	1	2	3	4	5
More likely to have a successful IT career	1	2	3	4	5
Less committed to the organization	1	2	3	4	5
More likely to be satisfied in their job	1	2	3	4	5
More likely to be absent	1	2	3	4	5
More likely to leave the organization	1	2	3	4	5
Other, namely _____	1	2	3	4	5

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15. Now consider the ongoing training and development for your IT employees.

This organization	**Strongly Disagree**				**Strongly Agree**
Requires our existing employees to maintain (keep updated) their IT related certification	1	2	3	4	5
Encourages participation in in-house training and development	1	2	3	4	5
Encourages participation in externally provided training and development	1	2	3	4	5
Provides funding for IT certification programs facilitated by an outside vendor	1	2	3	4	5
Actively supports employee learning	1	2	3	4	5
Has stated policies on the amount of training IT employees can expect to receive	1	2	3	4	5
Has stated policies on the type of training IT employees can expect to receive	1	2	3	4	5
Other, namely _____	1	2	3	4	5

16. Finally, consider your opinions about the benefits of industry-sponsored credential programs in the IT industry.

I believe that industry-sponsored credentials.....	**Strongly Disagree**				**Strongly Agree**
Make it easier for us to identify the applicant's knowledge, skills and abilities	1	2	3	4	5
Make the recruitment process easier	1	2	3	4	5
Make the recruitment process cheaper	1	2	3	4	5
Make the recruitment process more time efficient	1	2	3	4	5
Reduce the training costs for IT workers	1	2	3	4	5
Reduce the amount of time for a new employee to learn his/her job	1	2	3	4	5
Improve the ability to creatively problem solve IT problems	1	2	3	4	5
Improve the theoretical understanding of IT products, networks, and customer needs	1	2	3	4	5
Increase the chance of success for new employees	1	2	3	4	5
Foster feelings teamwork and camaraderie among our IT workers	1	2	3	4	5
Reduce the likelihood of turnover	1	2	3	4	5

Thank You For Your Time!

If you have questions, please feel free to contact:
Dr. Kenneth R. Bartlett, Project Director, Phone: 612-624-4935 e-mail: bartlett@umn.edu

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APPENDIX B

NATIONAL RESEARCH CENTER
NATIONAL DISSEMINATION CENTER

INTRODUCTION I.T. EMPLOYEE SURVEY

Thank you for your interest in participating in this national study conducted by the National Research Center for Career and Technical Education at the University of Minnesota. Please answer the following three questions to determine your eligibility to participate in the study.

This study is focused on IT industry-sponsored credentials which are defined as IT training programs leading to a certificate designed and supported by IT companies and professional associations such as Microsoft Certified Systems Engineer, Certified Novell Administrator, A+ Certified, and Sun Certified Programmer for the Java Platform.

1. Are you an IT (information technology) employee? ☐ yes ☐ no

If no, this survey is for IT employees only. Thank you for your interest in our study.

2. Respond to the following statement—
Industry-sponsored IT credentials are important to my career success.
- ☐ strongly agree
- ☐ somewhat agree
- ☐ neutral
- ☐ somewhat disagree
- ☐ strongly disagree

3. How many industry sponsored credentials do you have?
- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5 or more

It would be greatly appreciated if you would complete a more detailed survey to further explore your attitudes on the role of industry-sponsored credentials in the IT industry. Your organization is one of a small number selected from a national database of firms with 500 or more employees. Your participation represents many other IT employees, so the information you provide is vital in understanding the role of IT industry-sponsored credentials. Participation is voluntary.

The survey is anonymous; no one (including no one in your organization) will know that you were a participant. The survey is a continuous page and should only take 12 minutes to complete.

If you are interested, please insert your company e-mail address below and an access number and survey webpage will be sent to your official company e-mail account.

This information is being requested to provide an authenticated access code to the survey. The information is being sent to M. B. Hunt Software Inc. who is hosting this survey on a secure server. All identifiers will be eliminated before the data is reported to researchers.

Your Company Name (confidential) _____
Your Company E-mail address (confidential) _____

Feel free to e-mail me if you have questions or would like an alternative survey format
Thank you for your interest!

Ken Bartlett, Project Director
bartlett@umn.edu
Ph# 612-624-4935

APPENDIX C

NATIONAL RESEARCH CENTER
NATIONAL DISSEMINATION CENTER

I.T. EMPLOYEE SURVEY

ALL INFORMATION COLLECTED WILL BE KEPT ABSOLUTELY CONFIDENTIAL

Please respond to each statement according to the directions provided above each section. There are several sections and in spite of the similarity of some statements it is very important that you respond to each and every statement. Only then can your opinions be included in the final analysis. This is **not** a test and there are no right or wrong answers, so please respond as honestly and accurately as you can. This survey contains 63 questions and should take about 12 minutes to complete.

Your responses will be held in strict confidence.
No individual data will be released to anyone.

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Part of this study focuses on "Industry Sponsored Credentials" which are defined as IT training programs leading to a certificate that is designed and supported by IT companies and professional associations such as Microsoft Certified Systems Engineer, Certified Novell Administrator, A+ Certified, and Sun Certified Programmer for the Java Platform.

From the list below, please indicate companies/professional associations from which you have IT certificates.

- ☐ Cisco
- ☐ CIW
- ☐ CompTIA
- ☐ Dell
- ☐ Hewlett Packard
- ☐ IBM

Professionals

- ☐ Microsoft
- ☐ Novell
- ☐ Oracle
- ☐ Sun Microsystems
- ☐ Others (Baan, Synbase, SAP, Adobe, etc.

Please indicate your level of agreement by selecting the number that best reflects your feelings. To what extent do you believe that industry sponsored credentials...

	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
Determine the needed knowledge and skills for IT jobs.	1	2	3	4	5
Make it easier to identify the applicant's knowledge and skills.	1	2	3	4	5
Make the recruitment process easier.	1	2	3	4	5
Make the recruitment process cheaper.	1	2	3	4	5
Make the recruitment process more time efficient.	1	2	3	4	5
Reduce our training costs for IT workers.	1	2	3	4	5
Reduce the amount of time for a new employee to learn her/his job.	1	2	3	4	5
Reduce the ability to solve IT problems creatively.	1	2	3	4	5
Reduce the theoretical understanding of IT products, networks, customer needs.	1	2	3	4	5
Increase the chance of success for a new hire.	1	2	3	4	5
Foster feeling of teamwork and camaraderie among our IT workers.	1	2	3	4	5
Reduce the likelihood of turnover.	1	2	3	4	5

The following 13 questions are related to your feelings towards learning.

	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
Learning on the job will increase personal productivity.	1	2	3	4	5
I believe training will help me to do my current job better.	1	2	3	4	5
When I leave training, I can't wait to get back to work to try what I learned.	1	2	3	4	5
I get excited when I think about using my new learning on my job.	1	2	3	4	5
It is unrealistic to believe that mastering the content of training programs can improve my work productivity.	1	2	3	4	5
Before I attend training programs, I usually identify particular problems or projects that I would like the training to help me with.	1	2	3	4	5
I am usually able to use skills or knowledge acquired in training programs in my work.	1	2	3	4	5
I like to apply new knowledge I learn from co-workers.	1	2	3	4	5
Applying new learning to my job is a waste of time.	1	2	3	4	5
At work, I am motivated to apply new knowledge.	1	2	3	4	5
I intend to change jobs within this firm in the foreseeable future.	1	2	3	4	5
I intend to seek work in a profession other than IT in the foreseeable future.	1	2	3	4	5
I intend to seek IT related work at another firm in the foreseeable future.	1	2	3	4	5

The following 21 questions are related to your feelings about your organizational learning environment. Please indicate your level of agreement by selecting the number that best reflects your feelings.

	Almost Never True					Almost Always True
In my organization, people help each other learn.	1	2	3	4	5	6
In my organization, people are given time to support learning.	1	2	3	4	5	6
In my organization, people are rewarded for learning.	1	2	3	4	5	6
In my organization, people give open and honest feedback to each other.	1	2	3	4	5	6
In my organization, whenever people state their view, they also ask what others think.	1	2	3	4	5	6
In my organization, people spend time building trust with each other.	1	2	3	4	5	6

	Almost Never True					Almost Always True
In my organization, teams/groups have the freedom to adapt their goals as needed.	1	2	3	4	5	6
In my organization, teams/groups revise their thinking as a result of group discussions or information collected.	1	2	3	4	5	6
In my organization, teams/groups are confident that the organization will act on their recommendations.	1	2	3	4	5	6
My organization creates systems to measure gaps between current and expected performance.	1	2	3	4	5	6
My organization makes its lessons learned available to all employees.	1	2	3	4	5	6
My organization measures the results of the time and resources spent on training.	1	2	3	4	5	6
My organization recognizes people for taking initiative.	1	2	3	4	5	6
My organization gives people control over the resources they need to accomplish their work.	1	2	3	4	5	6
My organization supports employees who take calculated risks.	1	2	3	4	5	6
My organization encourages people to think from a global perspective.	1	2	3	4	5	6
My organization works together with the outside community to meet mutual needs.	1	2	3	4	5	6
My organization encourages people to get answers from across the organization when solving problems.	1	2	3	4	5	6
In my organization, leaders mentor and coach those they lead.	1	2	3	4	5	6
In my organization, leaders continually look for opportunities to learn.	1	2	3	4	5	6
In my organization, leaders ensure that the organization's actions are consistent with its values.	1	2	3	4	5	6

The following 12 questions focus on job satisfaction, your company training policies, and your commitment to your firm. Please indicate your level of agreement by selecting the number that best reflects your feelings.

	Strongly Disagree	Disagree	Slightly Disagree	Neither Disagree or Agree	Slightly Agree	Agree	Strongly Agree
All in all, I am satisfied with my job.	1	2	3	4	5	6	7
In general, I don't like my job.	1	2	3	4	5	6	7
In general, I like working here.	1	2	3	4	5	6	7

	Strongly Disagree	Disagree	Slightly Disagree	Neither Disagree or Agree	Slightly Agree	Agree	Strongly Agree
My organization has stated policies on the amount and type of training the employees can expect to receive.	1	2	3	4	5	6	7
I am aware of the amount and type of training that my organization is planning for me in the coming year.	1	2	3	4	5	6	7
This organization provides access to training.	1	2	3	4	5	6	7
I would be very happy to spend the rest of my career in this organization.	1	2	3	4	5	6	7
I really feel as if this organization's problems are my own.	1	2	3	4	5	6	7
I do not feel like "part of the family" at my organization.	1	2	3	4	5	6	7
I do not feel "emotionally attached" to this organization.	1	2	3	4	5	6	7
This organization has a great deal meaning for me.	1	2	3	4	5	6	7
I do not feel a strong sense of belonging to my organization.	1	2	3	4	5	6	7

Finally, we are interested in learning a little information about you. Once again, your responses will be kept confidential.

What is your gender? ❑ Female ❑ Male

What is your education level (highest level completed)?

❑ High school diploma ❑ Some college/formal training ❑ Two-year associate's degree

❑ Four-year college degree ❑ Master's degree ❑ Doctoral degree

How long have you been employed in **this organization**?_____ Years

How long have you been employed in **an IT/computer related field**? _____ Years

Thank you for your time.

APPENDIX D

Table A1

Factor Analysis: Recruitment and Industry-Sponsored Credentials

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.267	75.583	75.583	2.267	75.583	75.583
2	.467	15.554	91.137			
3	.266	8.863	100.000			

Note. Extraction method: Principle component analysis.

Table A2

Factor Analysis: Industry-Sponsored Credentials and Career Success

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.316	57.904	57.904	2.316	57.904	57.904
2	.741	18.534	76.438			
3	.587	14.673	91.110			
4	.356	8.890	100.000			

Note. Extraction method: Principle component analysis.